CHAPTER 12
RECLAMATION PLAN

12.1 RECLAMATION OBJECTIVES

Navajo Mine is committed to a reclamation goal that will restore the land affected by mining to a condition comparable to the pre-mining conditions and uses. Major objectives in achieving this goal include:

Objective 1: Restoring the affected land to a condition capable of supporting the land uses it was capable of supporting prior to mining.

The primary pre-mining land use is livestock grazing. Navajo Mine will restore the affected land to a grazing capability equal to or greater than the pre-mining capability.

Secondarily, the land serves as wildlife habitat. Specific surveys to monitor wildlife use of reclaimed areas are conducted annually during the summer and winter. The procedure involves vehicle or on-foot surveys during which the observed species and their numbers are recorded. Results of these monitoring activities will be submitted to the regulatory agencies. These studies will be periodically evaluated as to their utility in monitoring wildlife use of reclaimed areas.

Objective 2: Conserving and utilizing the suitable plant growth media, including topdressing, alluvial sandy materials, and lighter textured overburden on affected lands to the extent necessary to meet Objective 1.

Suitable topdressing materials will be salvaged to a maximum depth of five feet from sites prior to mining. Suitable regolith will be salvaged as required to maintain a material balance. These materials will be redistributed on graded land or placed in stockpiles as required.

Objective 3: Establishing on all affected areas a diverse, effective, and long lasting vegetative cover of the same seasonal variety as the native vegetation.

The vegetation will be self-perpetuating with cover and production values equivalent to those established in the baseline surveys. Revegetation will be oriented toward the postmining land uses of livestock grazing on rangeland and enhancement of wildlife habitat.

Objective 4: Reclaim affected areas in an environmentally sound manner and as contemporaneously as possible with the mining operation.

Results from baseline studies and research programs are integrated into the reclamation plan to ensure that adequate environmental protection and conservation measures are conducted in the reclamation practices. Such measures include: use of native species where suitable for revegetation, use of species palatable for livestock and wildlife, and use of fencing to minimize unauthorized grazing on revegetated areas.

Objective 5: Minimize disturbance to the hydrologic balance and restore prominent drainage features of the permit area to approximate the pre-mining conditions.

Results from investigations of the hydrologic functions of the affected area have been incorporated into the operation and reclamation plan to ensure the hydrologic integrity of the site. Final hydrologic conditions will approximate those prior to mining.

All reclamation activities will be in compliance with plans submitted in the application.

12.2 RECLAMATION TIMETABLE

12.2.1 Annual Reclamation Timetable

Topdressing and regrade operations are year-round activities, as shown in TABLE 12-1. Topdressing verification and removal (CHAPTER 11, OPERATION PLAN, Section 11.2.1) take place immediately ahead of drilling and blasting operations. Primary grading is conducted to meet reclamation timetables. Secondary grading is performed as necessary to form the final contours. Topdressing replacement (Section 12.5.1) follows grading after the spoil analyses have been reviewed and the root zone has been determined to be suitable.

Rough discing follows topsoil placement, when necessary, to help prevent erosion, promote water infiltration, and minimize compaction created by topdressing equipment.

Revegetation may occur any time between March and October. Irrigation on newly seeded plots begins in April and continues through October. Fencing of reclaimed areas, following seeding, is conducted year-round, as necessary, to keep livestock out.

TABLE 12-1

ANNUAL RECLAMATION TIMETABLE

Activity	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
TOPDRESSING SAMPLING	X	X	X	X	X	X	X	X	X	X	X	X
TOPDRESSING REMOVAL	X	X	X	X	X	X	X	X	X	X	X	X
PRIMARY GRADING	X	X	X	X	X	X	X	X	X	X	X	X
SECONDARY GRADING	X	X	X	X	X	X	X	X	X	X	X	X
TOPDRESSING PLACEMENT	X	X	X	X	X	X	X	X	X	X	X	X
SEEDBED PREPARATION	X	X	X	X	X	X	X	X	X	X	X	X
SEEDING			X	X	X	X	X	X	X	X		
MULCHING AND CRIMPING			X	X	X	X	X	X	X	X		
IRRIGATION			X	X	X	X	X	X	X	X		
FENCING	X	X	X	X	X	X	X	X	X	X	X	X

Vegetation is sampled during the last two years of the liability period and as often as needed in the interim to determine trends of successful revegetation. The sampling is done from June through October.

12.2.2 Backfilling and Grading Schedule

SMCRA regulation state backfilling and grading activities "shall occur as contemporaneously as practicable with mining operations" (30 CFR 816.100). BNCC use the following guidelines to define practicable backfilling and grading:

- Sufficient equipment capacity and manning levels to sustain constant progress backfilling available areas simultaneous with mining operations
- Holding equipment and manning levels at a steady rate (not hiring or laying off extra people to meet demands caused by short term fluctuations in available regrade volumes).
- Allowing spoil material that is reserved to fill final pits and ramps to remain ungraded in place until the final pits or ramps are available to fill (not double handing material to develop out-of-pit spoil dumps)

BNCC provides information for short term and long term backfilling and grading. Both of these sources combined constitute the backfilling and grading plan.

Short term information is provided in EXHIBIT 12-32a and 12-32b. BNCC will continue these commitments through 2009. The continued use of these exhibits will be discussed at the 2009 annual meeting. EXHIBIT 12-32a shows detailed regrading, mitigation and topsoil areas by year for three years. EXHIBIT 12-32b shows detailed revegetation and irrigation areas by year for three years.

Long term backfill and grading information is provided in TABLE 12-2 (Regrade Volume by Area) and FIGURE 12-2-1 (Reclamation Volume Available...) . TABLE 12-2 (Regrade Volume show the approximate volume of material placed in final regrade of Area 2 and Area 3 by fiscal year until all pits in those areas are completely regraded. In addition, Figures 12.2-2 through 12.2-4 (Regrade, Mit/Topsoil and Reveg. Acres by Year...) provides estimated acreages to be completed by fiscal years through life of mine for regrade, mit/topsoil and revegetation. These estimated acreages will periodically reviewed and adjusted as needed.

Disturbed acres in this table are based on EXHIBITS 12-1 through 12-3, Permit Term Disturbance Schedule. FIGURE 12.2-1 shows a summary schedule for the final regrading of Area 2 and Area 3. The bars represent the cumulative fill volume available for final regrade i.e. final pits, ramps or fill areas. The lines represent the planned volume to be placed in final regrade in that fiscal year. FIGURE 12.2-1 and TABLE 12-2 do not provide information on the number of acres completed as "final regrade", regrade acres are provided in EXHIBIT 12-32a and 12-32b. The volumes presented in TABLE 12-2 and FIGURE 12.2-1 are general estimates based on the current mine plan and may be altered due to unforeseen significant changes

There are several factors in determining the appropriate timing for contemporaneous reclamation to be completed. Five examples of these factors are explained below.

1. Pit Backfill A buffer of approximately 4500 feet from the centerline of the final pit is required to leave enough cut material to backfill the final pit to FSC elevation. In order to successfully time the backfilling of pits, some spoil material must remain in place until their final resting place becomes available for regrading to the FSC. This material is required for backfilling the ramps and pits, and will not be moved until the designated location for that material is available to be filled.

2. Drainage Construction. The re-establishment of postmining drainages requires that some acres not be regraded during active mining, but regraded after the area is inactive. This allows ramps and pits to be backfilled to proper elevations to establish drainage either through the old pits and ramps or through other mined-out areas as dictated by the Final Surface Configuration (FSC).

3. Maximization of Coal Recovery. In some areas, the land must not be regraded until a later date in order to facilitate future coal recovery in adjacent areas.

4. Disposal of Coal Combustion By-products (CCB). In some areas, the land may not be regraded immediately after it becomes available in order to facilitate ash disposal.

In FY 2011, the first 'jog' in Dixon Pit and the dragline stripped pit in Hosteen/Yazzie become available for backfilling. In FY 2014, the final Lowe Pit and the second 'jog' in Dixon Pit become available for backfill. In FY 2019, the final Dixon Pit becomes available. In 2020, the final Hosteen/Yazzie Pit becomes available for backfill.

According to the Long-Term Regrade Plan, Barber Pit backfilling will be completed in FY 2015. Lowe Pit backfilling will be completed in 2019. Final backfilling for both Area 2 and Area 3 will be completed in FY 2021. Table 12.2-1 shows the estimated annual material movement in Area 2 and Area 3.

12.2.3 Topdressing Replacement Schedule

Mitigation and topsoiling will be completed within two years of final regrading. For a more detailed explanation of the final regrading schedule, refer to EXHIBIT 12-32a. In situ resources will be the source of topsoil material. This material can be direct placed by mobile equipment, stockpiled as necessary, or selectively handled with the dragline. Selective handling will occur when the material source is large enough and the dragline sequencing allows for it.

Factors which may affect the timely completion of topdressing replacement include:

1. Proximity of in situ topdressing resources to facilitate direct haul and respread of this material.
2. Economic considerations.
3. Scheduling and capacity constraints.

Table 12-2

Regrade Volume by Area

Volume Moved (Bank Cyds)	Location		
Year	Area 2	Area 3	Area 4
2010	6,113,331	4,602,065	
2011	5,583,134	4,826,890	
2012	4,249,955	5,770,431	
2013	4,942,521	5,463,651	
2014	5,452,429	4,064,407	
2015	6,063,844	4,378,689	~~248,000~~
2016	3,759,176	6,781,872	~~1,140,000~~
2017	2,500,000	8,308,488	~~2,330,000~~
2018	2,500,000	7,354,127	~~3,320,000~~
2019	2,500,000	10,775,504	
2020	5,500,964	4,599,732	~~2,660,000~~
2021	2,192,310	5,052,194	~~5,930,000~~
2022			~~4,571,000~~

Estimated volume (cubic yard) of spoil material moved each fiscal year for cut and/or fill requirements to meet Final Surface Configuration (FSC)

Figure 12.2-1

Reclamation Volume Available for Fill and Volume Regraded by Fiscal Year

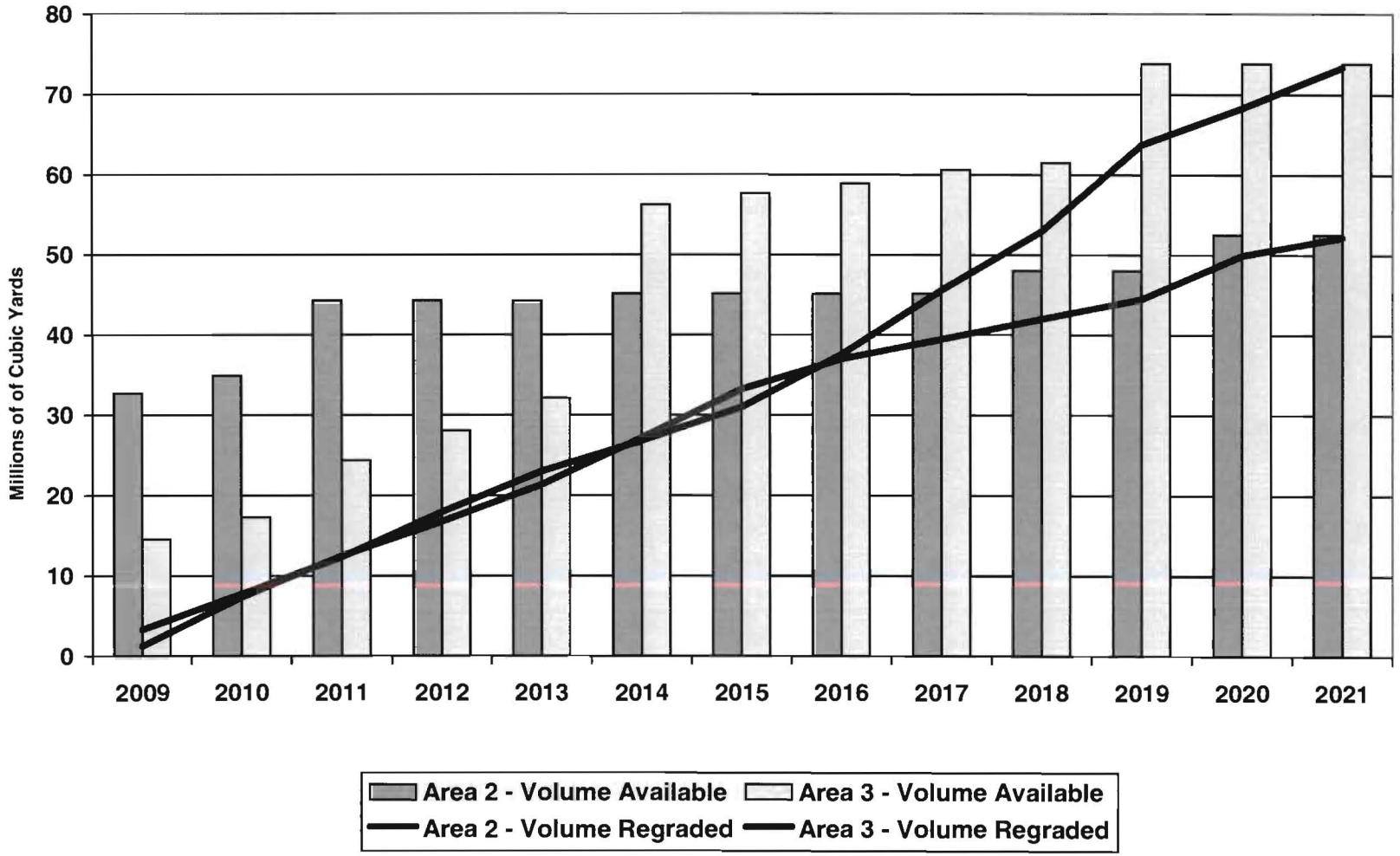


Figure 12.2-2

Regrade Schedule by Year and Pit

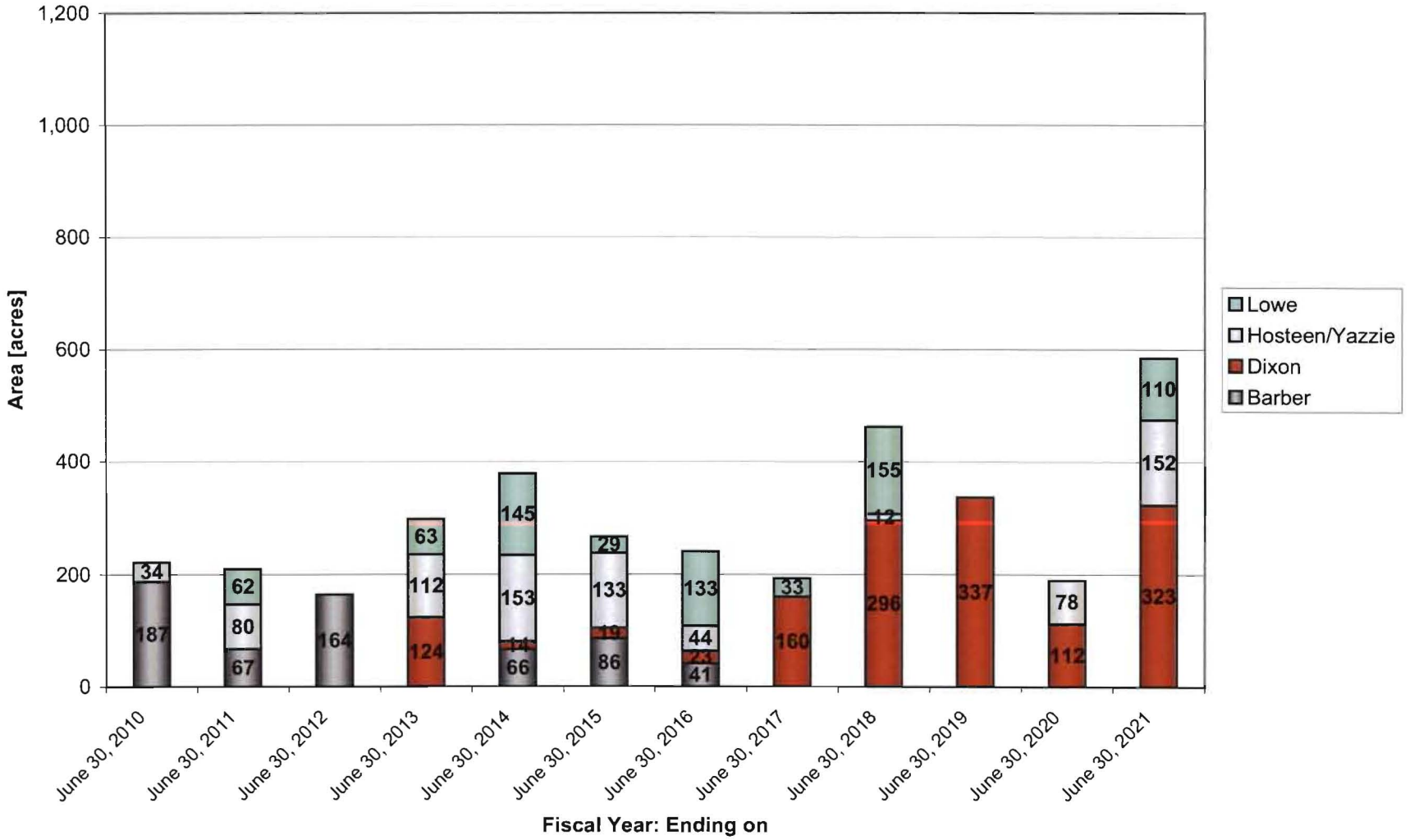


Figure 12.2-3

Topsoil and Mitigation Schedule by Year and Pit

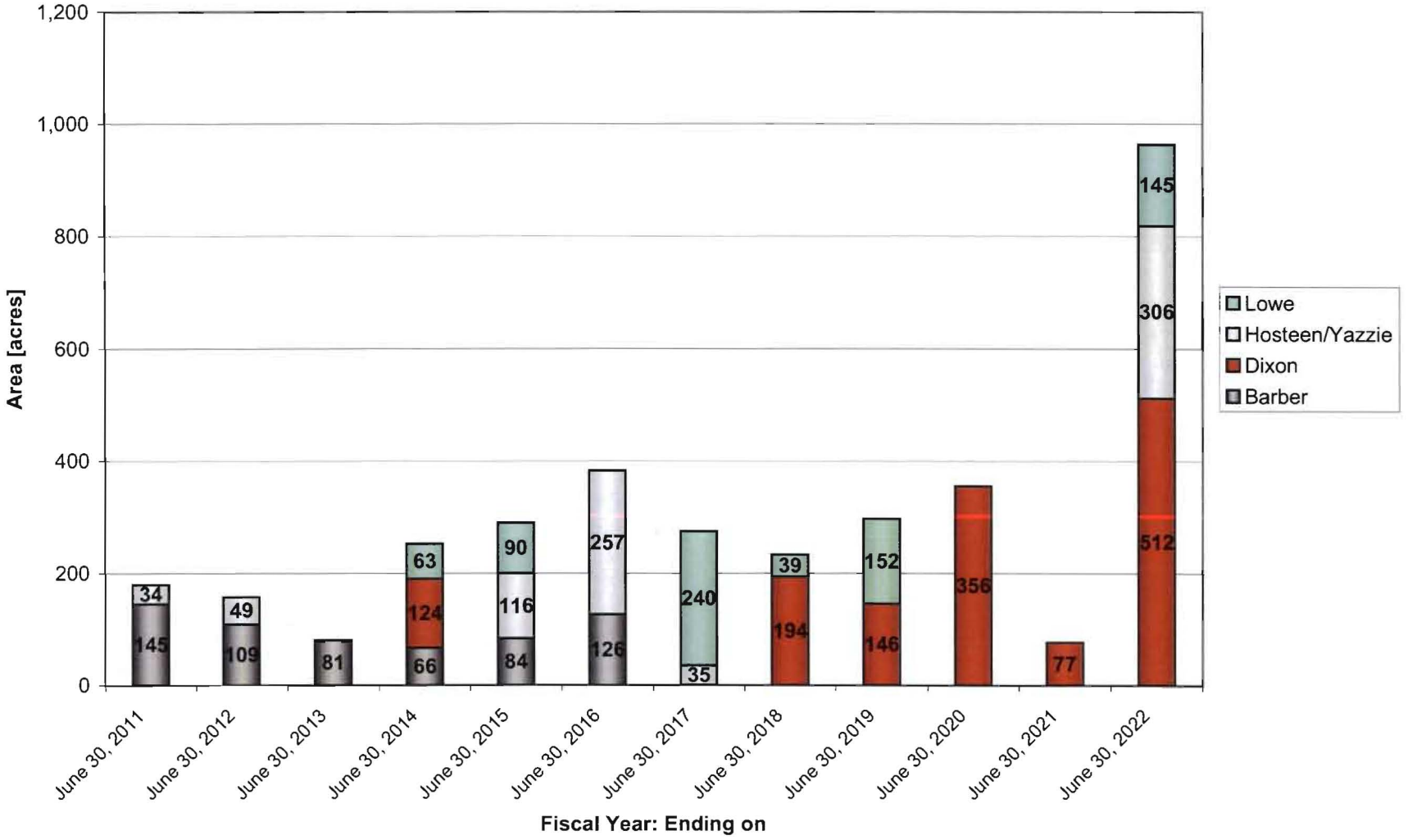
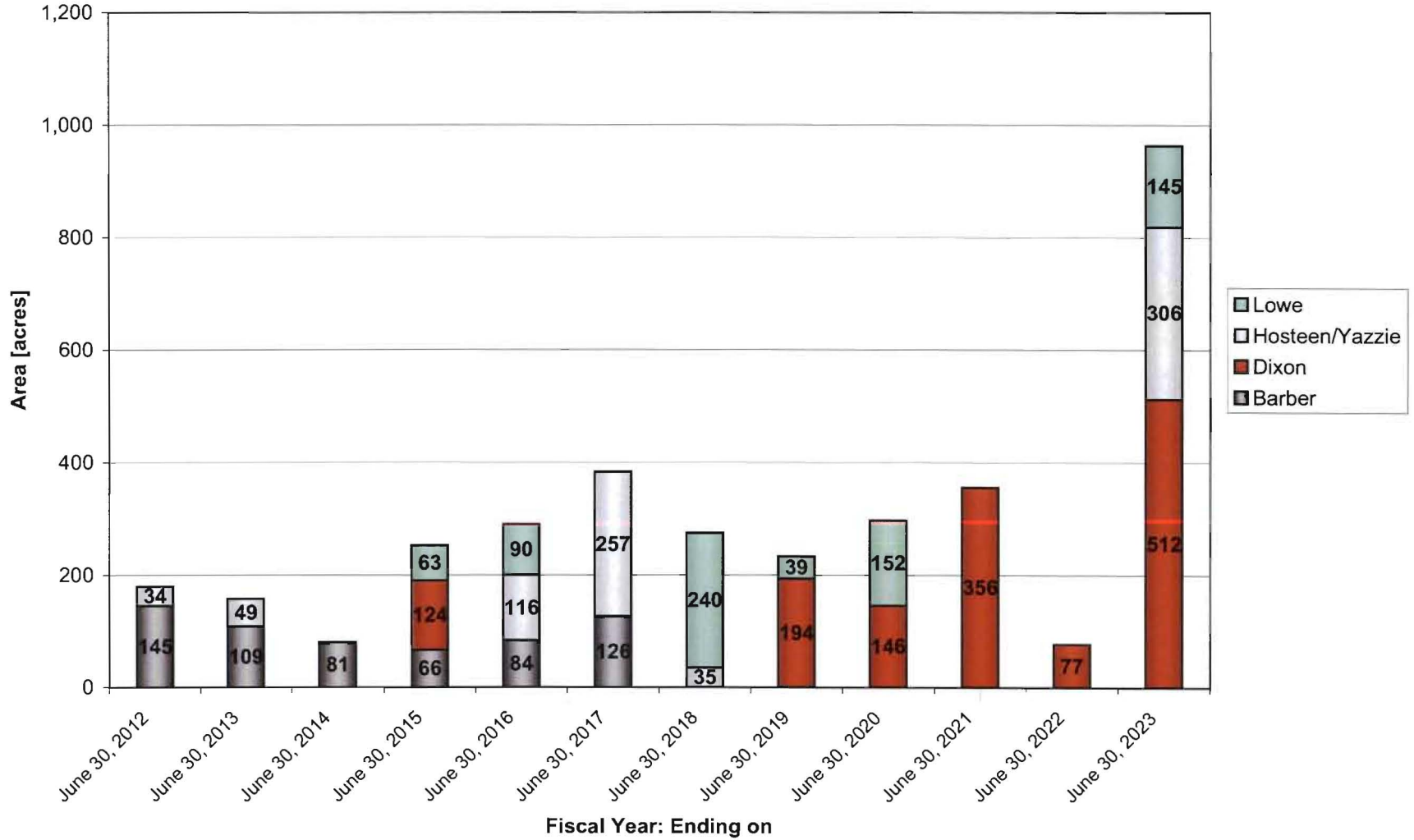


Figure 12.2-4

Revegetation Schedule by Year and Pit



12.3 BACKFILLING AND GRADING

As described in CHAPTER 11, Section 11.3.2 overburden and parting material is removed by a dragline and cast into the adjacent mined out cut. Such placement creates spoil ridges (rows) or peaks which need to be backfilled and/or graded. Backfilling and grading will be done in logical blocks that follow the stripping sequence allowing large areas to be regraded at one time. This will provide a more consistent topography between regraded areas and will improve irrigation coverage by providing large, continuous areas rather than small irregular blocks. In most cases, these logical blocks become available every 1-3 years in each mining area, which will result in a substantial distance between the previous regraded area and the active pit just prior to the block becoming available. The areas around and in active ramps will be regraded to provide a road suitable for mining activities that include coal haulage. Pre-Stripping ahead of the active mining strip allows for the material removed to be used in backfilling and grading. These materials are used to backfill finished pits, active mining ramps, and regrade areas requiring additional fill. Final pits will remain open until all mining activities are complete, at which time they will be backfilled. The backfilling and grading operations of each logical block are divided into primary and secondary operations.

Primary regrading utilizes track dozers to level off the spoil ridges. Primary regrading will be accomplished as necessary to accommodate the FSC and the reclamation schedule in TABLE 12-2. Some pits and ramps may not have sufficient backfill material readily available for bulldozers to adequately regrade the area. In these instances, supplemental equipment may be used to facilitate primary regrading activities. This equipment includes, but is not limited to, scrapers, draglines, and end-dump trucks working with a large front-end loader.

Several areas at Navajo Mine may require delays in reclamation in order to facilitate reaching the desired postmining topography. Changes or fluctuations in the dragline stripping sequence may cause variations in spoil placement resulting in localized peaks or valleys that may require regrading equipment and cause primary regrading delays.

Secondary regrading may, if needed, follow primary grading for additional smoothing of the land surface to accommodate topdressing replacement. At this time, any special water control or wildlife habitat features will be constructed.

During the process of secondary grading, small depressions may be established on an opportunistic basis. These features will enhance post-mining topographic diversity and act as seasonal surface water collection sites. Small depressions will serve as wildlife enhancement features and micro-topographic niches for establishment of mesic and/or hydric plant species. Although these depressions will not have specific design criteria, they will be small enough that they will occur within the limits of the approved FSC. These small depressions will also meet the following specific criteria:

- Each depression or combination of directly adjacent depressions will be less than one acre foot total capacity
- No depression will be deeper than 10 feet
- All small depressions will be incised (below ground level)
- The maximum inslope for the small depression will be 6:1 and
- At bond release, small depression areas will be subject to vegetation sampling similar to any area within the bond release parcel

Highwalls and ramps will be backfilled and graded as shown on the FSC maps (EXHIBITS 12-4 through 12-7). Interior slopes will be graded to less than or equal to 6.5 horizontal to 1 vertical (6.5h: 1v) overall. All outslopes of the affected areas will be graded to less than or equal to 4h: 1v overall. The overall slope will be measured from the crest to the toe of the slope. On long slopes a portion of the slope between the crest and toe could be steeper to facilitate the construction of terraces. The analysis indicates that the weighted average soil loss from a post-mining watershed exceeds the per-mining condition then terraces are constructed on long steep slopes to shorten the slope lengths and thereby minimize the erosion off the slope. Drainage details are available in CHAPTER 11 and in the Reclamation Surface Stabilization Handbook (BHP- Navajo Mine, 1992), which was approved by the Office of Surface Mining Reclamation and Enforcement (OSMRE) in 1992. In locations where ash disposal has occurred, disposed ash volumes will be taken into consideration when developing the FSC.

Regraded lands are blended into the surrounding topography to establish drainage patterns, and the postmining land use of range livestock grazing will be unimpaired following topdressing distribution and revegetation.

Final Surface Configuration Or Approximate Original Contour

Through the mining process, the original or pre-mine surface configuration and surface contour are altered. Reclamation plans are based on grading the mined areas to meet specific criteria outlined in this section. In order to ensure that these criteria will be met and the material balance maintained, designs of a new topographical surface are created based on current mine plans and features for a given operating area. This replacement surface is defined as the Final Surface Configuration (FSC) or Approximate Original Contour (AOC); both terms can be used interchangeably within this permit. Reclamation plans are based specifically around meeting the drainage requirements of this FSC (or AOC) surface. Because this FSC (or AOC) surface is created from a modeled post mine surface, the actual contour configuration of the reclaimed topography may deviate from the design FSC (or AOC). The locations, configurations, and timing of mining plans and features may vary slightly from plans (e.g. ramp centerline locations, dragline plug locations, and so forth). However, these deviations will not be significant The actual reclaimed surface will closely approximate the approved FSC (or AOC) and this surface will ensure current FSC (or AOC) drainage designs are maintained, still meet the requirements this section, and ensure a material balance.

The Final Surface Configuration (FSC) is achieved at Navajo Mine by:

1. Achieving mass balance while maximizing contemporaneous regrade acreage between ramps without requiring disturbance of revegetated pre-law lands,
2. Achieving positive drainage, except for the small depressions mentioned above, from all areas including pits and ramps,
3. Developing an adequate drainage density, and
4. Allowing development of stable drainage channels.

Area I

The Area I North final surface configuration is shown in EXHIBIT 12-5. The northwestern portion of the exhibit is characterized by a hill that primarily slopes to the southeast. The area to the southeast is featured by a hilly terrain that contains a drainage. This drainage is called the Bitsui Wash that leaves the permit site to the north. The area from the Bitsui Wash to the southwestern corner of the exhibit is generally sloped to the northeast. The Dodge Diversion, originating near N 2,070,000 and a smaller drainage are located in this area. These two drainages facilitate the entire Area 1 North up to the Bitsui Wash. Cross sections for Area I North are shown in EXHIBIT 12-35. These cross sections illustrate that the post-mining surface generally resembles the pre-mining topography.

Near Doby Ramp 7 is hill (Power Pole Hill) that contains slopes on the south side that exceed 6.5h: 1v. This hill is pre-law but a narrow strip of Permanent Program land that traverses the toe was added to capture the public access across the mine. During reclamation of this road, slopes in excess of 6.5h: 1v were constructed in order to tie-in with the steep Pre-law slope. The area of Power Pole Hill containing the slopes is roughly 1 acre in size, is stable with respect to erosion and has established perennial vegetation

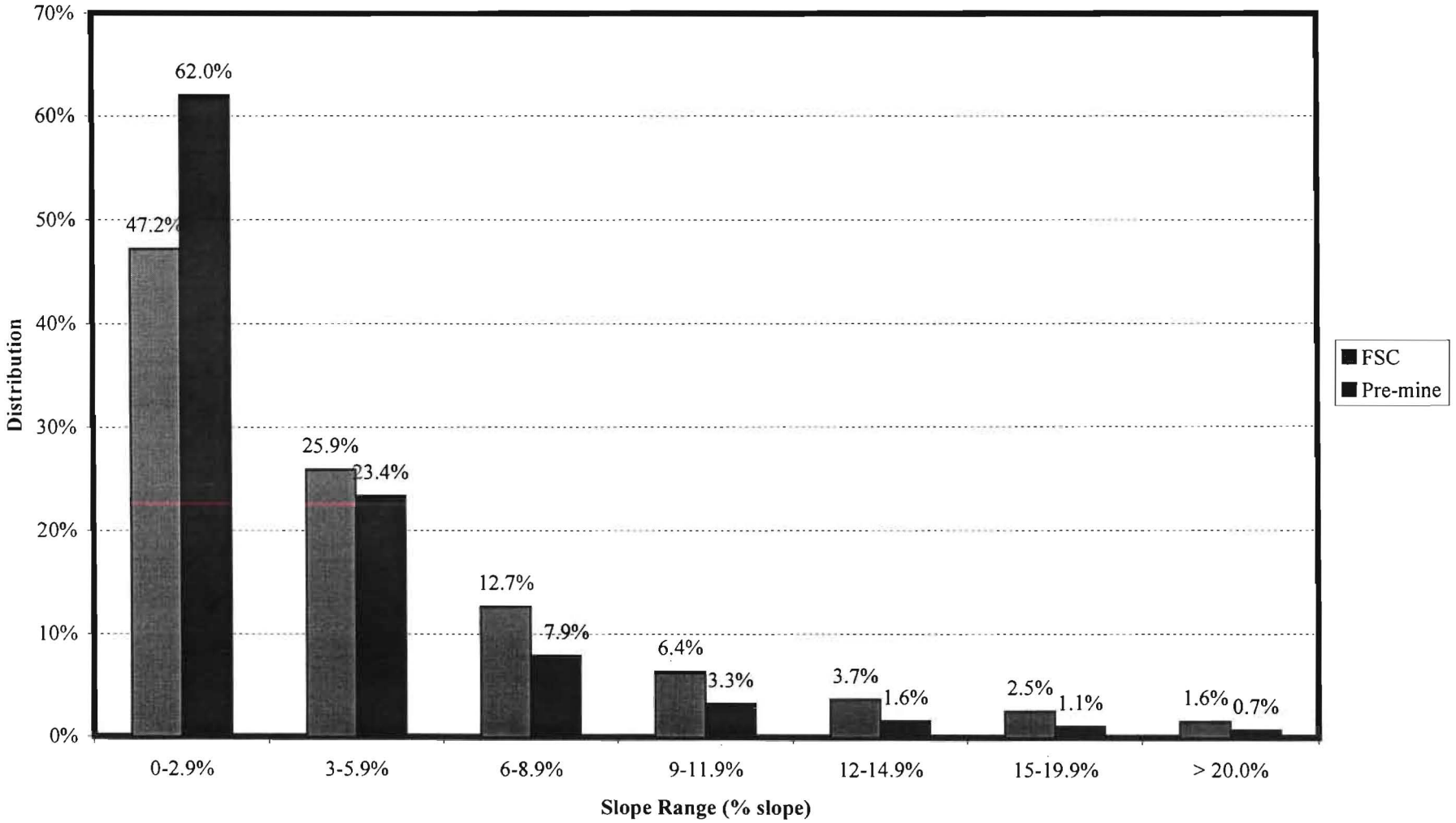
The Area I South final surface configuration is shown in EXHIBIT 12-5A. The topography is described to be a moderately sloped terrain. The area between N 2,070,000 and N 2,065,000 divides and generally slopes to the east and west. The western slope will start dipping to the north near the lease line and tie in with the Area I North. The eastern half will drain off lease before connecting with a drainage to the south. This drainage is called the Chinde Diversion that will trend westerly near N 2,055,000. The area south of N 2,065,000 will generally be sloped to the southwest corner of the exhibit or the Big Fill area. This terrain will be moderately flat and trend across the Bighan and Doby Ramps down to the Chinde Diversion. The Area I South slope

histogram shown in Figure 12.3-1 illustrates the post-mining slope distribution to generally be the same as the pre-mining distribution.

Area II

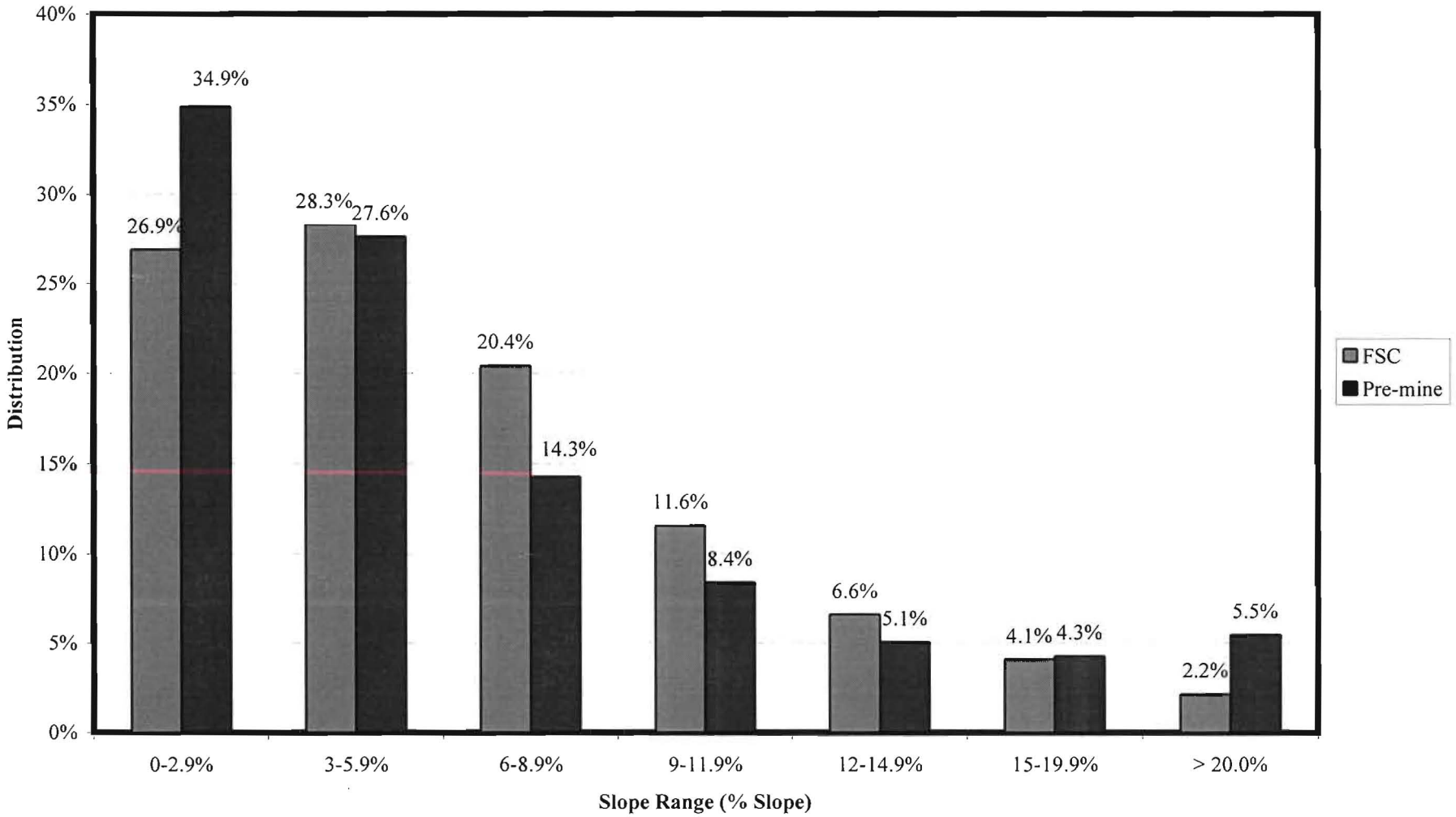
The Area II final surface configuration is shown in EXHIBIT 12-6A and 12-6B. EXHIBIT 12-6A displays the Chinde Diversion, discussed in Area I, and another drainage trending from the Figure 12.3-1

Figure 12.3-1
Area 1 (South of Ramp 7) Slope Histogram



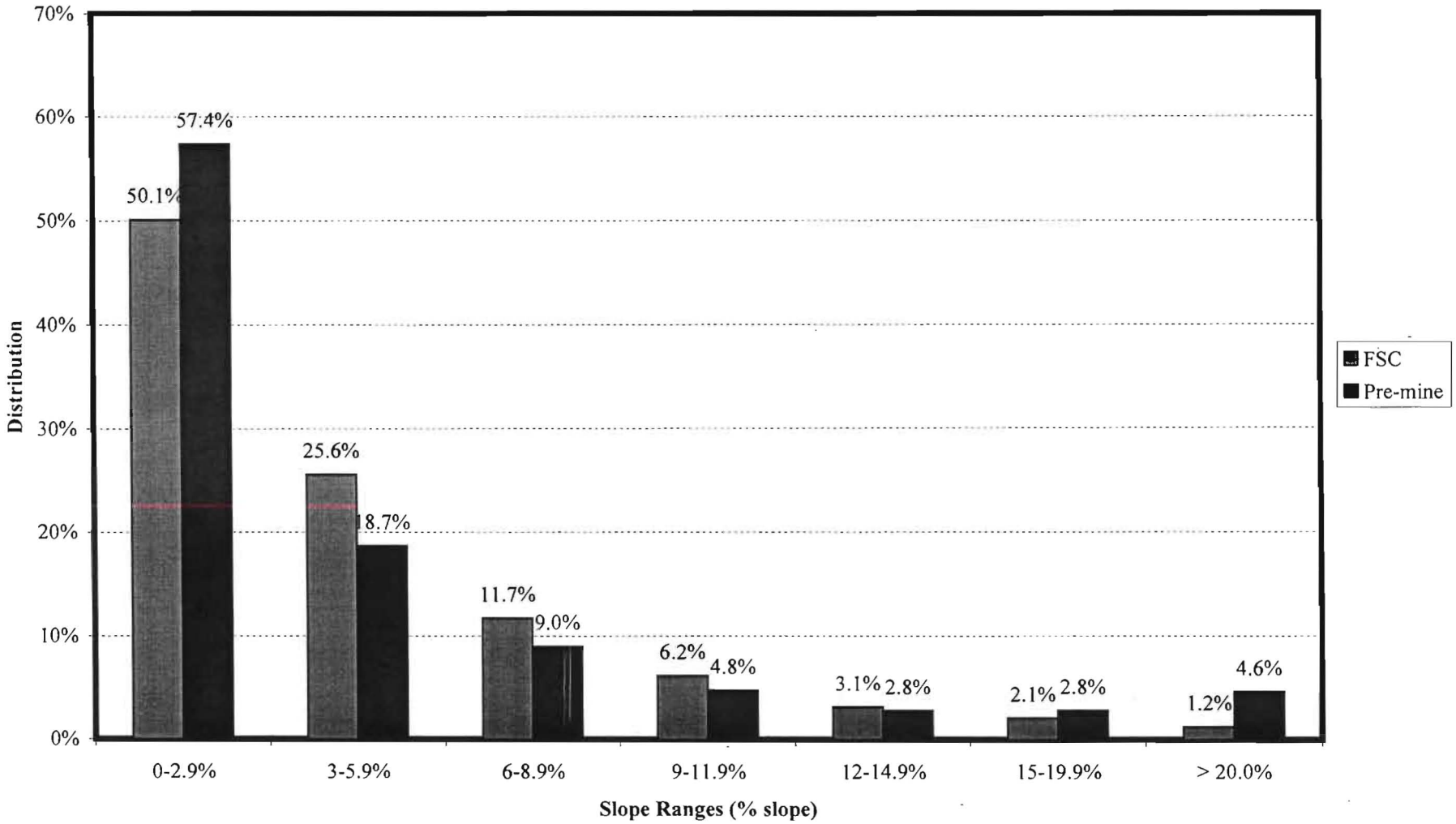
(7/98; 9/06)

Figure 12.3-2
Area 2 Slope Histogram



(10/04; 5/05)

Figure 12.3-3
Area 3 Slope Histogram



(7/03; 10/06)

Figure 12.3-4
Area 4 North Slope Histogram

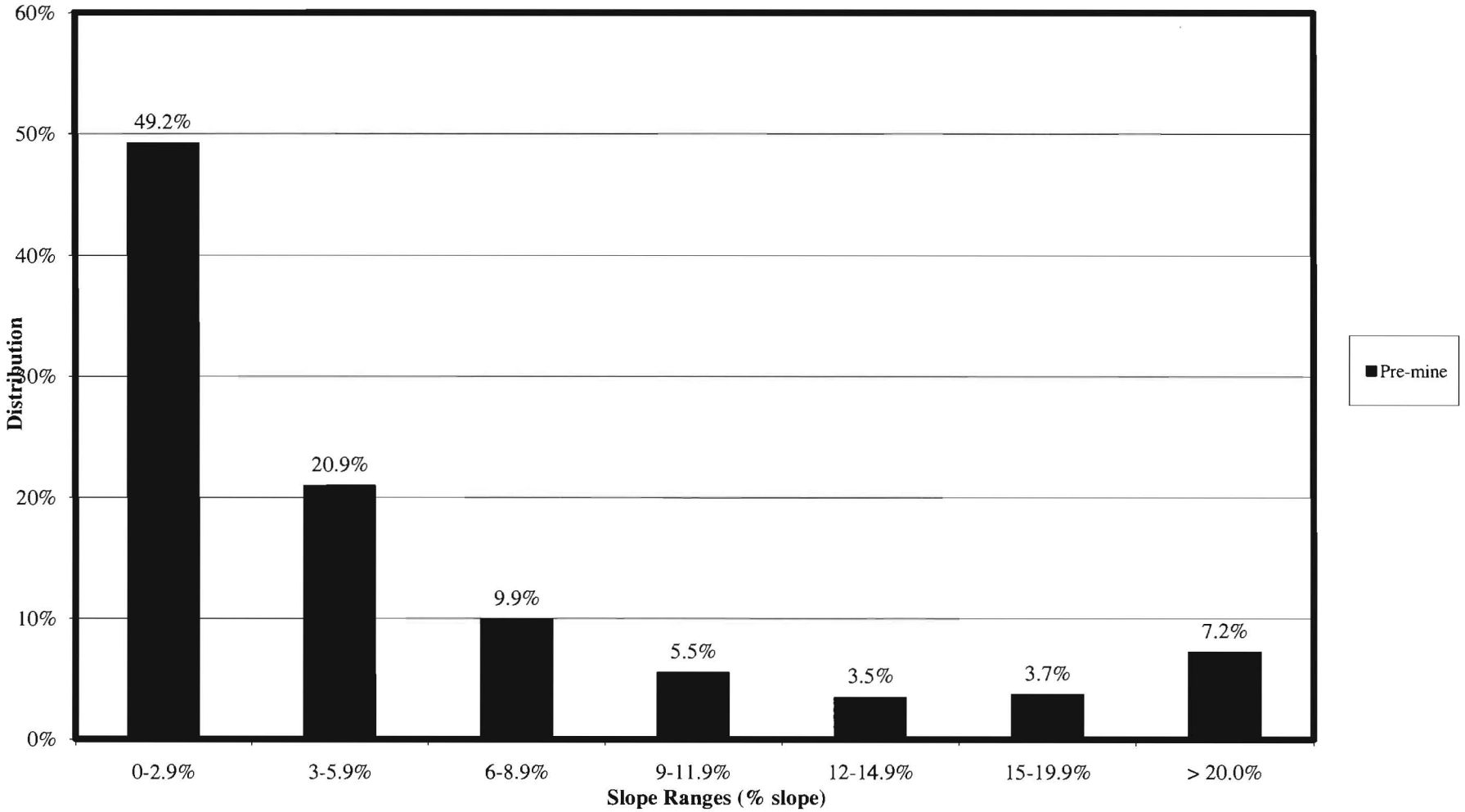


Table 12 - 8

Slope Distribution by Area for Pre- and Post-mining Topography

Percent

	Area 1			Area 2			Area 3			Area 4 North		
	AOC	PRE	Variance	AOC	PRE	Variance	AOC	PRE	Variance	FSC	PRE	Variance
0-2.9%	47.2%	62.0%	**-14.8%**	26.9%	34.9%	**-8.0%**	50.1%	57.4%	**-7.3%**		49.3%	**-49.3%**
3-5.9%	25.9%	23.4%	**2.6%**	28.3%	27.6%	**0.7%**	25.6%	18.7%	**6.9%**		11.5%	**-11.5%**
6-8.9%	12.7%	7.9%	**4.7%**	20.4%	14.3%	**6.1%**	11.7%	9.0%	**2.7%**		9.3%	**-9.3%**
9-11.9%	6.4%	3.3%	**3.1%**	11.6%	8.4%	**3.2%**	6.2%	4.8%	**1.4%**		5.3%	**-5.3%**
12-14.9%	3.7%	1.6%	**2.1%**	6.6%	5.1%	**1.5%**	3.1%	2.8%	**0.3%**		3.5%	**-3.5%**
15-19.9%	2.5%	1.1%	**1.5%**	4.1%	4.3%	**-0.2%**	2.1%	2.8%	**-0.7%**		5.0%	**-5.0%**
> 20.0%	1.6%	0.7%	**0.8%**	2.2%	5.5%	**-3.3%**	1.2%	4.6%	**-3.4%**		16.0%	**-16.0%**
Total	100%	100%		100%	100%		100%	100%		0%	100%	

Acres

	Area 1			Area 2			Area 3			Area 4 North		
	AOC	PRE	Variance	AOC	PRE	Variance	AOC	PRE	Variance	FSC	PRE	Variance
0-2.9%	1,035	1,360	**(325)**	1,579	2,047	**(467.6)**	2,060	2,359	**(298.9)**		347	**(347.5)**
3-5.9%	568	512	**56**	1,660	1,622	**38.5**	1,052	768	**283.6**		81	**(80.9)**
6-8.9%	278	174	**104**	1,198	838	**360.0**	481	369	**111.8**		65	**(65.4)**
9-11.9%	140	72	**68**	679	493	**186.0**	255	196	**59.3**		37	**(37.5)**
12-14.9%	81	35	**46**	387	297	**89.5**	129	115	**14.3**		25	**(24.7)**
15-19.9%	56	23	**33**	240	251	**(11.3)**	85	116	**(30.7)**		36	**(35.5)**
> 20.0%	34	16	**19**	126	321	**(195.2)**	50	189	**(139.3)**		113	**(112.8)**
Total	2,193	2,193		5,870	5,870		4,113	4,113		-	704	

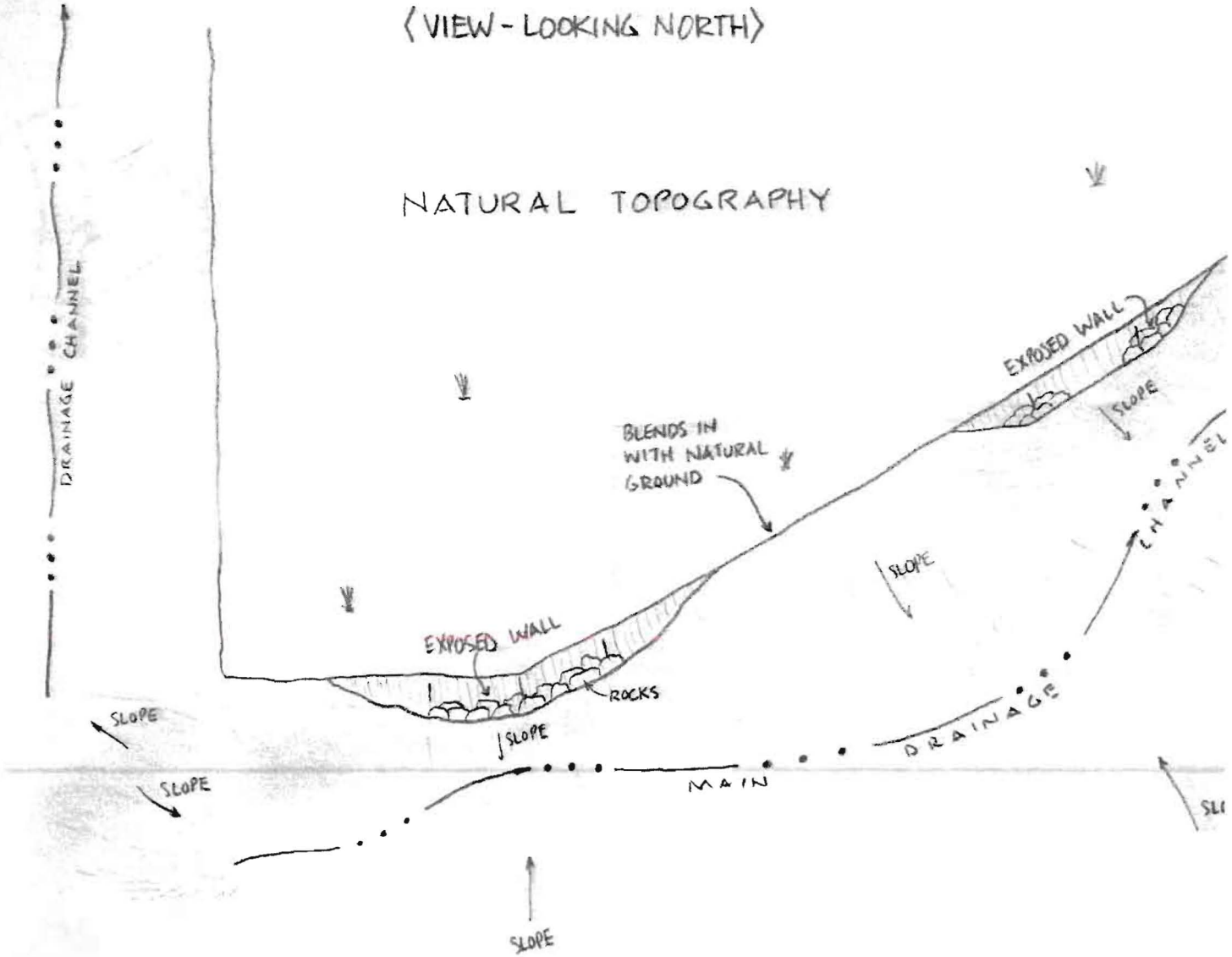
southeast to the northwest exiting at the Big Fill area. The drainage will run parallel but not directly on top of the final pit of North Barber. This channel will be routed through the final pits of Hosteen and Yazzie to merge with the Chinde Diversion. To the west of the drainage, the topography transitions into a hilly terrain sloping to the northwest. In EXHIBIT 12-6, the rolling terrain extends to the southwest where the topography flattens into moderate hills. This flat terrain contains drainages that trend from the southeast to northwest. Figure 12.3-2, Area II Slope Histogram shows the post-mining slope distribution to generally be the same as the pre-mining distribution.

In order to reestablish topographic diversity, bluff features will be constructed in the Block C area. These features will be established to recreate bluffs removed during the mining process. The location of premine bluffs are shown in Exhibit 12-42. Prior to disturbance, approximately 2,580 linear feet of native bluffs existed in the proposed disturbance area with slopes ranging from 25% to 60%. Prior to mining, the native topography in the Block C area included bluff-like features in the form of rock outcroppings, steeply sloped badlands with exposed rock strata and caprock, and scoria capped knobs. The constructed bluff features will consist of insitu overburden including fractured siltstones, mudstones, sandstones, and shales. In constructing the bluff features, the existing highwall will be backfilled to a minimum of 3 feet above the exposed rider coal seam leaving no more than 20 feet of exposed rock face. The bluff features will be constructed as shown in the conceptual drawing (see Figure 12-3). The area of constructed bluff features will be approximately 500 linear feet in length with no more than 20 vertical feet of exposed bluff. The constructed bluff features are intended to promote postmine topographic diversity in the Block C area and may be considered a wildlife enhancement feature. In addition, the bluff features will result in an increase in sinuosity of the reconstructed drainage in the reclaimed area. The native area drains to the north away from the constructed bluff features and no major spalling or slope instability should occur; however, similar to natural bluffs the face of the bluff is expected to physically weather over time, which will result in the creation of a rubble zone at the base of the feature. Based on the availability of suitable competent rock, rubble zones may also be constructed with boulders at the base of the bluff features to further enhance the utility of the features for wildlife and mimic natural bluffs in the area.

Figure 12-3

BLOCK C - CONCEPTUAL DESIGN

⟨VIEW - LOOKING NORTH⟩



Area III

The Area III final surface configuration will generally be a flat terrain with moderate hills between drainages. The northern section will typically be flat with drainages directed to the west. These northern drainages will reconnect with the western half of the Lowe Arroyo. To the east, the final Lowe and north Dixon Pits will be regraded to become a drainage channel aligned to the south, west and north, back to Lowe Arroyo. The drainages in south Dixon will tie in with the Cottonwood Arroyo. The Area III final surface configuration is shown in EXHIBIT 12-7.

Figure 12.3-3, Area III Slope Histogram generally shows the lower slope range (0-2.9%) to decrease and increase in the middle slope range (3-5.9% to 12-14.9%). The rolling topography created by the drainage system over a primarily flat pre-mine area will decrease the lower slope range and increase the middle slope range distribution.

12.3.1 Root-Zone Sampling

Final regraded material will be sampled to determine its suitability for use as root-zone material. The regraded material will be sampled on a 2.5-acre square grid. Sampling will be conducted after regrading is complete and before placement of topsoil or topsoil substitute.

The 2.5-acre plot will be divided into 4 equal subplots (0.625 ac. each). A four-foot sample pit will be excavated in the center of each subplot (Figure 12-1) and two composite samples will be collected from these four sampling locations. Samples will be collected from the 0-1 ft and 1-4 ft vertical intervals (8 samples total). These samples will then be split (16 samples total) in the field using a corner to corner sampling technique (USDA-NRCS 1996). Half of the split samples will be combined into the two composite samples (0-1ft and 1-4ft intervals). Composite samples

will contain equal volume (2 liters) of material from each of the four subplots by each interval. The remaining half of the samples will be archived and not composited horizontally. These archived samples will be used to further identify the extent of unsuitable material as needed. Specific composite sampling procedures are presented in Figure 12-2.

When **regolith** is used, both as root-zone and topsoil substitute for an area, sampling will consist of excavating four pits with a backhoe to a depth of approximately five feet. Composite samples will be collected at the 1-2 ft and 2-5 ft intervals respectively. The surface 6-12 inches will be sampled in accordance with Section 11.2.1.2 for topsoil substitute suitability.

When native materials are encountered during sampling of regraded spoil material, the procedures described below will be followed:

1. Only disturbed materials will be sampled as described above. Field observations including; (1) depth and thickness of interval, (2) identification of lithological constituents, (3) Munsell color, and if incompetent/unconsolidated, (4) texture-by-feel analysis will be recorded to define each distinctive layer of native material. The backhoe test pit wall will be photographed clearly showing the in-place native materials. To substantiate the existence of native material, field observations and photographs will be included in the annual root-zone monitoring reports, or

2. In the case where native materials are encountered within the top 12 inches of final graded root-zone material. The top 12 inches of the final graded root-zone material, including the native materials, shall be sampled and analyzed in accordance with the sampling methodologies described above.

Quality Assurance and Quality Control (QA/QC) Program

A QA/QC program will be followed as required in the soil and overburden sampling plan. The QA/QC program is described in APPENDIX 12-A

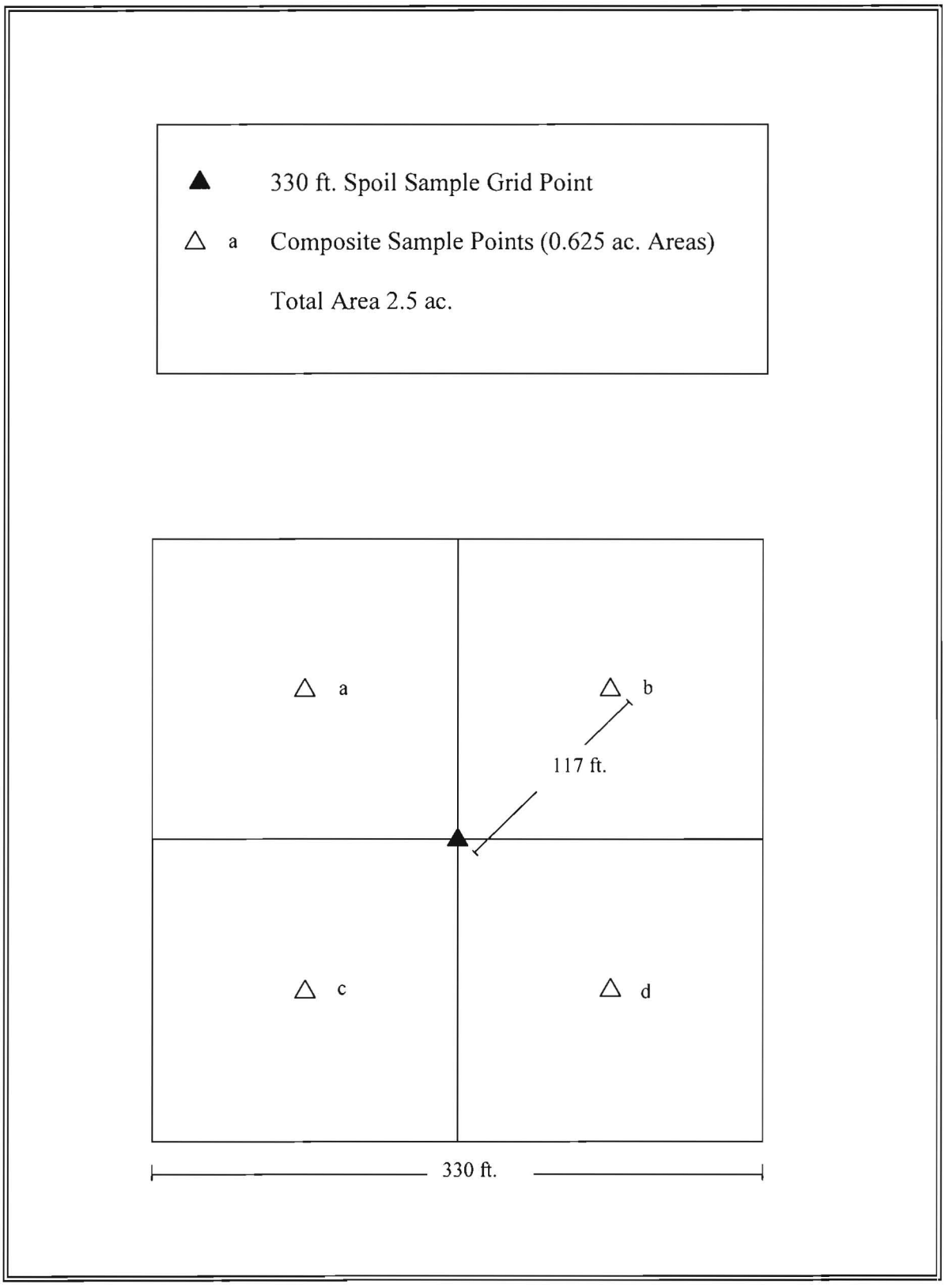


FIGURE 12-1. Spoil Sampling Layout

TABLE 12-3

OSMRE ROOT ZONE SUITABILITY CRITERIA FOR NAVAJO MINE[1]

Characteristic	Suitability Limits	Analysis Method
1. SAR	≤18 **OR** ≤40 only if: EC≥4 mmhos/cm	Page, A. L., et al. Method of Soil Analysis, ASA No. 9, Part 2, 1983
2. pH	≥5 and ≤9	Page et al., 1983
3. EC	≤16 mmhos/cm	Page et al., 1983
4. Acid-Base Account	≥ -5 t $CaCO_3$/1000 t	Sobek, A. A., et al., 1978, EPA 600/2-78-054
5. Texture	≤50% Clay	OSMRE Letter 8/26/86, paragraph 3.6.
6. Saturation	≤85% **OR** ≤100% only if EC≥4 mmhos/cm	Richards, 1954 Agricultural Handbook No. 60
7. Selenium - Total	≤2.5 ppm	Bajo, 1978[2]
8. Selenium - Soluble	≤0.26 ppm	Page, et al., 1983

[1] Criteria to be applied to each separate sample increment.

[2] The Bajo Method of total digestion shall to be followed by the Hydride Method of detection.

Root-Zone Analysis

The samples are sent to a soil analytical laboratory for analysis. Methods of analysis and analytical parameters are listed in TABLE 12-3.

Root-Zone Suitability

Root-Zone suitability will be determined by using the OSMRE ROOT-ZONE SUITABILITY CRITERIA FOR NAVAJO MINE, (TABLE 12-3). Maximum threshold limits (MTL) for total Selenium (Se) and hot-water soluble Se were established based on a May 2000 report entitled, "Proposed Root-Zone Suitability Criteria for Total and Hot-Water Soluble Selenium at the Navajo Mine." This report fully justified a modification of the MTL for total Se to 2.5 ppm and hot water soluble Se to 0.26 ppm. In December 2001, an analysis of historical spoil data from 9,068 samples justified eliminating the requirement for boron analysis in spoil materials. This data showed that removing boron from analysis would not adversely affect the suitability of root-zone reconstruction materials or reclamation success.

When unsuitable material is identified from the composite samples, the archived samples will be analyzed to further identify the extent of the unsuitable material. This second set of analysis will identify which 0.625 ac subplot requires mitigation. The extent of the unsuitable material will determine the appropriate mitigating action. This may include one or more of the following options:

1. Removing the unsuitable material and placing it in a mining pit, resulting in burial with at least four feet of suitable root-zone material.
2. Covering the affected area with suitable root-zone material (i.e., suitable spoil or regolith) to the required depth.
3. Treating or amending the unsuitable material. If this option is selected, OSM will be consulted to discuss the alternative plan prior to implementation.

4. No mitigation of native materials encountered during regraded spoil sampling will be conducted; however, topdressing will be placed on the regraded surface as approved in Section 12.5

Regardless of the option used, once mitigation has been accomplished, the areas will have 4 feet of suitable material. Navajo Mine has demonstrated to OSM that currently stockpiled regolith (Lowe #9 &10 and Dixon #2 & 3) is suitable for use as mitigation and/or topsoil substitute with out the need to sample post-distribution (approved 8/17/98). Therefore, if mitigation has been accomplished with stockpiled regolith, the area will not be resampled. If mitigation occurred with material other than stockpiled regolith (insitu regolith) the area will be resampled after mitigation consistent with the root-zone sampling methods. The results of any option will meet both the requirements of the approved FSC plan and the OSMRE Root-Zone Suitability Criteria for Navajo Mine.

Root-Zone Reports

Annual root-zone monitoring reports will be prepared, filed at the mine, and submitted to OSMRE on or before August 31 of each full annual reporting year. The results of the analysis shall be on file for review during OSMRE inspections. These reports will cover the period from July 1 to June 30 of each year and include the following information:

1. Data analysis sheets from each grid location sampled during the reporting period, including pre and post mitigation data,

2. Recorded field observations and photographs of native material encountered during sampling.

3. Grid location noted on 1:6000 scale (1 inch = 500 feet) map which delineates the regraded area.

4. Northing, easting, and elevation of each 330 foot grid sample site

Root-Zone Sampling for Terrace Construction

Terraces are constructed using suitable spoil material after the area is regraded, sampled, and mitigated according to procedures described in section 12.3 and 12.3.1. If a specific area requires the construction of terraces to prevent erosion, additional suitable spoil material (meeting root-zone suitability criteria) will be transported to the area after the area has been mitigated. This spoil material will be sampled and handled in the following manner.

A site is selected in non-graded spoil peaks near the pit. Spoil peaks are smoothed with initial dozing. Once the area is dozed the standard 330′ spoil sample grid is used to select sample sites. A 10′ composite sample is collected at each sample site. Sample pits are excavated to a depth of 10′ using a backhoe. The backhoe bucket is used to scrape the side of the pit over the entire length (10′). This material is deposited on a tarp to ensure adequate mixing and a sub-sample is collected from the pile. Samples are analyzed for the approved root zone suitability criteria. Sampling spoil in 10′ composite samples is appropriate as the handling of the material after it is sampled will result in mixing the spoil similar to the mixing which occurs when samples are composited.

Spoil material used to construct terraces will be removed in 10′ lifts with loaders, dozer, and end dump trucks. This process of removing and handling spoil material ensures that the material is adequately mixed. Mixing occurs when the material is loaded into trucks with the loaders and dozer. Additional mixing occurs when the material is dumped out of the trucks at the site of construction and final mixing occurs when the material is shaped into terraces by dozers. This extensive mixing of the spoil material justifies the method of using a 10′ composite to validate suitability.

Surveying and grade stakes will be used to ensure material will only be removed in 10′ (maximum) lifts.

All laboratory data associated with pre-sampling of spoil material used in terrace construction will be included in annual root-zone suitability report.

Mitigation Resources

TABLE 12-9 identifies sources of suitable root-zone material by mine area. The table also provides an estimate of mitigation needs by mine area. This mitigation material inventory will be updated on an annual basis and provided as part of the Annual Root-Zone and Topdressing Report submitted to the OSM on or before August 31. The sources of mitigation material, a brief description of the type of material, and discussion of salvage, stockpiling, and use of these mitigation resources is provided below.

Estimated Mitigation Rates

OSM approved changes to Navajo Mine's Root-Zone sampling methods on October 1, 1999. It was anticipated that the changes to the sampling method would result in a change in the mitigation rate. The volume of mitigation material needed by mine area in TABLE 12-9 is based on a mitigation rate of 5% for Areas I and II with total-rootzone volume of (323 yds^3/ac) and 10.8 percent for Areas III and IV of the total root-zone volume (697 yds^3/ac). This mitigation rate is based on a statistical evaluation of actual root-zone data collected at Navajo Mine since 1990.

Historic root-zone data (330-ft grid) from adjacent sites were arranged in groups of four to simulate collecting composite samples within a 2.5-acre sample plot. The 0-1 ft samples and the 1-4 ft samples were combined mathematically, providing one composite sample each of the 0-1 and 1-4 ft increments. Grouping four individual 330-ft grid sample sites resulted in a data set with 145 sample sites representing 1,450 acres. This data was evaluated using the OSMRE Root-Zone Suitability Criteria for Navajo Mine. This evaluation was used to estimate the number of sites where samples exceeded regulatory standards and to estimate the volumetric requirements for mitigation.

AREA I

Area I currently has sufficient amounts of suitable root zone material that can be used for the purposes of mitigation resource. Based on the adjusted mitigation rate of 5%, material from DBR13 TS W(Pre-Law Pile) will meet the requirements with approximately 23,000 cyds surplus.

DBR13_TS_W is located north of the Hosteen/Yazzie pit areas and material will remain in its current location used for mitigation purposes. The location and volumes of these resources are identified on the Detailed Soils Maps located in CHAPTER 8 and on TABLE 11-3A.

AREA II

Mitigation material in Area II consists mainly of suitable spoil material located in Barber Spoil Area and consolidated sandstone material in the Yazzie Overlook. Both of these resource areas have been identified on the Detailed Soils Maps in CHAPTER 8 and volumes in TABLE 11-3A and TABLE 12-9.

The Barber Spoil Area, was identified as mitigation borrow area that will provide suitable mitigation material. The identified material has been sampled and will be available for mitigation purposes. Below is the Selective Handling Plan for suitable spoil mitigation material to minimize cross contamination from surrounding spoil.

- Establish a two track road around boundary
- Pre-shift inspection of the area
- Utilizes GPS navigation for dozers and loaders
- EQ Department will be contacted if any spoil fire should occur
- A 25' buffer will be placed around spoil fire and material will not be used as suitable material

In May 1999 two additional holes were drilled, one on the east (BB1) and one on the west (BB2) boundary of the Yazzie mesa. The 1999 drill holes were not analyzed for physical/chemical

properties. These holes were to determine the depth of the sandstone strata. Additionally, elevations of where the sandstone outcropped were surveyed and recorded along the eastern edge of the plot. This drill and elevation data was used to model the bottom of the suitable sandstone layer. In 1993 and 1994 a topdressing survey was conducted in the same area as the drill sampling program. This survey recorded the depth to bedrock (the top of the sandstone layer) in the area. This depth to bedrock data was used to model the top of the suitable sandstone layer.

AREA III

Mitigation material exists in the following regolith stockpiles:

LWR1 RG N

LWR4 RG N

DXR1 RG W

All resource areas have been identified on the Detailed Soils Maps in CHAPTER 8 and volumes identified in TABLE 12-9.

Area IV North

Area IV North has sufficient material needed for mitigation resources. To ensure adequate mitigation resources for Area IV North, overburden drilling data from Chapter 5 Section 5.4 of Navajo Mine Permit NM-0003F was evaluated against the OSMRE ROOT-ZONE SUITABILITY CRITERIA FOR NAVAJO MINE, Table 12-3. This drilling and sampling was conducted in 1987 with locations of the drill sites detailed in Table 5-1 and Figure 5-4. Appendix 5B, Tables 487-01 thru 487-05, contains physiochemical data for these sites. Four of these sites (487-01, 487-02, 487-03, 487-05), representing approximately 80% (2,440 acres) of the total acreage in Area IV North, contain in excess of 10 feet of suitable overburden material for Navajo Mine. Ten feet of material over 2,440 acres provides for a significant volume of suitable material, Table 12-9, which can be selectively handled to facilitate reclamation and ensure suitable rooting media. Further evaluation of this overburden material will be conducted in future drilling projects to more accurately delineate the extent of the material.

TABLE 12-9
MITIGATION RESOURCES AT NAVAJO MINE
December 2003

Mitigation Material Supply	Mine Area			
	I	II	III	IV North
Regolith Stockpiles (cyds)				
DXR1_RG_W			500,000	
LWR1_RG_N			2,412,152	
LWR4_RG_N			276,857	
Regolith In Situ Reserves (cyds)				
Dixon pre-strip			4,884,176	
Area IVN pre-strip				49,600
Miscellaneous Mitigation material (cyds)				
Doby Ramp 13 Prelaw Stockpile	413,000			
Yazzie Overlook[1]		574,000		
Yazzie Overlook South[1]	85,326	3,150,674		
Suitable Overburden [4]				39,365,333
Total Mitigation Available	498,326	3,724,674	8,073,185	39,414,933
Mitigation Needs				
Current disturbance as of Dec. 2003 (Ac.)	715	2,251	1,863	
Future disturbance through lease bound.(Ac.)	0	436	847	3,332
Total Acres to be Mitigated	715	2,687	2,710	3,332
Material needed to mitigate remaining acres (cyds)[5]	498,326	1,872,732	1,888,762	2,322,271
Difference	0	1,851,942	6,184,423	37,092,662

[1] These areas are loose consolidated sandstone overburden which will be removed during pre-strip operations

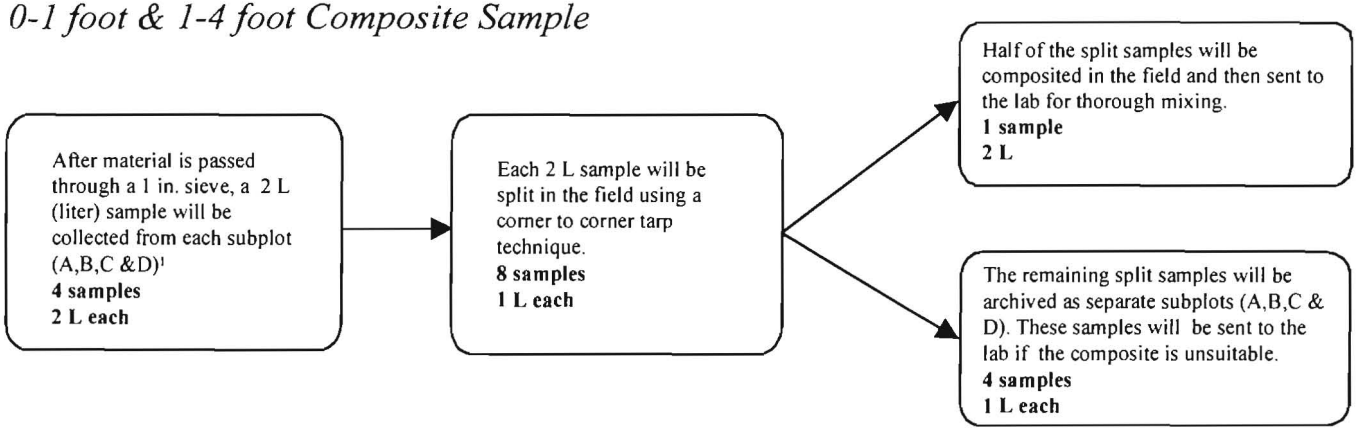
[2] These are previously mined spoils suitiable for mitigation material

[3] This material will be sampled more intensely when the top 400,000 yards have been removed

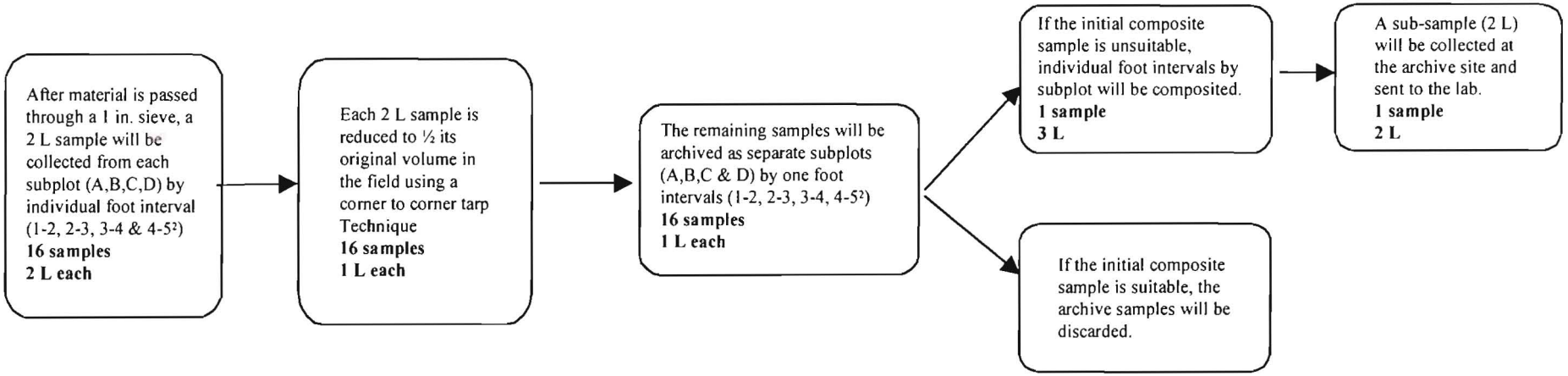
[4] This is approximately 80% (2440 acres) of Area IVN including drillsites 487-01, 487-02, 487-03, & 487-05.

Figure 12-2. Composite Sampling Procedures

0-1 foot & 1-4 foot Composite Sample



1-2, 2-3, & 3-4 foot Sample



[1] The 1-4 foot composite sample is collected in an even distribution from the side wall of the test pit.
[2] The 4-5 ft. interval will be sampled and archived. This sample interval will only be analyzed if the 0-1 ft. interval is unsuitable and it is removed from the plot.

12.3.2 Road Removal and Reclamation

Currently, Navajo Mine does not plan to retain any of the mine roads for postmining land use; however, prior to removal of roads BHP will consult with the Navajo Nation and identify any roads that the Navajo Nation would like retained. If any roads are to be retained the permit will be changed to reflect the permanent status of the roads. Consequently, the following reclamation measures are planned:

1. Where a road traverses otherwise undisturbed land, the natural drainages will be restored unless re-establishment would not enhance environmental values;

2. All culverts will be removed along with the removal of the associated road. The culverts will be salvaged, if possible, otherwise they will be disposed of in one of the final pits;

3. Roadbeds will be ripped, plowed, and scarified;

4. Fill slopes will be ripped and rounded or reduced and shaped to conform to the surrounding terrain and to meet natural drainage restoration;

5. Cut slopes will be shaped to blend with the regraded or natural contour;

6. Terraces will be constructed as necessary to prevent excessive erosion and to provide long term stability in cut and fill slopes, and;

7. Road surfaces will be covered with topdressing and revegetated according to the reclamation plan outlined in this chapter.

The anticipated removal dates of road segments is shown in Section 11.5.6, Table 11-11. The removal dates shown are the dates when the road segments are no longer required and removal can begin. Road segments that are in front of the advancing active pits will be mined out according to the mine plan.

12.3.3 Railroad Removal and Reclamation

The railroad and service road will be removed when mining operations terminate or when the facilities are no longer required. The current plan for completion of mining operations is scheduled for the year 2016, though it is highly likely that operations will be extended beyond this date. The removal of the railroad will begin at the time of ultimate closure.

Upon removal and reclamation of the railroad, all salvageable structures and equipment components will be disassembled and removed from the area. The unsalvageable materials, such as concrete, railroad ties and unsuitable rail will be disposed of in one of the final pits or by other approved methods. The reclamation of the railroad and service road will follow the measures in CHAPTER 12, Section 12.3.2 steps 1 through 7. The Big Fill removal will consist of hauling 580,000 cubic yards of material to Hosteen Ramp 3 for final ash cover.

12.3.4 Reclamation of Surface Water Controls

All surface water controls will be reclaimed and drainages re-established according to the following procedures and the timetable in TABLE 12-1:

1. Sediment from ponds will be analyzed for potentially unsuitable constituents prior to removal and reclamation. Any unsuitable sediments from the ponds will be disposed of properly (CHAPTER 11, Section 11.2.5). After a database has been established, a determination will be made as to whether future sediment analyses need to be made. (Year-round activities). In addition, in the process of reclamation, clay liners installed in certain ponds will be ripped and either (a) covered in-place with 4 feet of suitable (root-zone) material or (b) physically removed and disposed of in the active pit or the ungraded spoils. In either case, the clay liner material will no longer hold water.

- Removal must occur at least 2 years after the last augmented seeding of the area;
- The area has been stabilized and revegetated (i.e. the entire disturbed area that drains into the siltation structure has been stabilized with enough vegetative growth to reduce sedimentation);
- The sediment load of the runoff from the area has reached normal premining sediment loads (i.e., the area is not contributing additional sediment to streamflow or to runoff outside the permit area)
- Runoff and discharges from the area will not cause or contribute to violation of the water quality standards of the receiving waters

2. The pond areas will be topsoiled and disced. Regraded areas will be sampled prior to topsoiling. (Year-round activities),

3. Seedbed preparation, mulching, and discing will take place as necessary (see TABLE 12-1),

4. Seeding will take place after seedbed preparation is completed, or as soon as an acceptable seeding time frame is reached,

5. Irrigation will begin immediately after seeding and continue through October, or until establishment has been achieved,

6. The area will be fenced as necessary during irrigation to protect the area from grazing and unauthorized activities, and

7. Vegetation will be sampled in the last two years prior to land release, and in previous years as needed.

The above reclamation activities are described in detail in Sections 12.2 and 12.6.

The ponds and impoundments will be removed at the following times:

1. The North Sewer Pond, North Ponds 1 and 5, Emma's Pond, and the North Pinto Pond will be removed after operations and reclamation in the North Area Industrial Complex are completed,

2. Pinto Pond 1 will be removed after mining has ceased and reclamation in the area is completed,

3. Barber and Lowe loadout ponds will be removed after mining and reclamation activities in these areas are completed, and water for dust suppression on roads is no longer needed,

4. Hosteen Stockpile Ponds 1, 2, and 3 and Barber Stockpile Ponds 1, 2, and 3 will be removed after coal haulage has ceased and the adjacent stockpile areas have been reclaimed,

5. The Area III Sewage Pond, the Area III Shop Detention Pond, and the Area III Complex Pond will be removed after activities in the Area III industrial complex have ceased and the area has been reclaimed,

6. The Lowe Stockpile Pond will be removed after coal haulage has ceased and the adjacent stockpile areas have been reclaimed,

7. The Southwest Dixon Pond, Northwest Dixon Pond, and South Dixon Ponds 1 and 2 will be removed after the adjacent spoil outslopes have been reclaimed, and

8. The various highwall impoundments which are adjacent to Yazzie, South Hosteen, Barber, Lowe, and Dixon Pits will be removed when stripping activities reach their locations.

Prior to submitting an application to the regulatory authority for the removal of a siltation structure, Navajo Mine will consult with the Navajo Nation to assess the structure's retention value to meet the postmining land use.

Small depressions may be included in the final surface configuration as discussed in section 12.3 Backfilling and Grading. Preexisting stockponds disturbed by mining will be reconstructed after mining. All livestock ponds impacted by mining will be replaced as part of reclamation (CHAPTER 10, WILDLIFE, EXHIBIT 10-3). Ponds P2, P3, and P4, which have already been disturbed to date, will be reconstructed in nearby areas during reclamation. The original pond locations are designated as P2a, P3a, and P4a. The approximate postmining locations are designated as P2b, P3b, and P4b. Ponds P5, P6, P7, and P8, which have not yet been impacted, will be reconstructed on or near their original locations. Only pond P1 will not be disturbed by mining. All the reconstructed ponds will be built to accommodate the similar volume as estimated in TABLE 10-14. The orientation of the ponds will be dependent on the final slope and drainage pattern created during reclamation.

12.3.4.1 Permanent Impoundments

Location of post mining permanent impoundments should be constructed on or near original pre-mining locations as specified in Section 12.3.4. Consideration to placing post mining permanent impoundments in pre-mining locations will depend on watershed and surrounding topography suitability. Permanent impoundment location selection will be based on sufficient watershed size, to provide runoff for optimum water retention.

Permanent impoundments will be designed to not exceed a capacity of 10 acre-feet. Due to variability in watershed size, soil composition and slopes, impoundments will not be designed to retain runoff from a specific storm event. Fifty percent (50%) of pond side slopes will be designed to a 4:1 grade or less to facilitate wildlife and livestock access.

Impoundments will be constructed in spoil material (clay) that will aid in water retention through low permeability rates. Permanent impoundments will blend in with the post mining topography and incorporate topographic diversity to the extent possible. The supporting design data for permanent impoundments are presented in Appendix 12-E.

Inlet and outlet structures will be designed to remain stable during 25 year-6 hour precipitation events at peak discharge. Riprap material will be placed at the pond inlets and spillways if hydrologic analysis indicates that a protective lining is required to minimize and control erosion. Inlet / outlet structures must be designed to safely contain the 100 year-6 hour event at peak discharge while maintaining one foot of freeboard.

TABLE 12.3.4-1

PERMANENT IMPOUNDMENTS

IMPOUNDMENT ID.	LOCATION	WATERSHED AREA (ACRES)	CAPACITY (AC-FT)	DEPTH AT UPSTREAM TOE (FT)	NRCS HAZARD CLASSIFCATION	COMMENTS
LOWE PERMAENT IMPOUNDMENT 1	LOWE	1,623.8	9.67	SEE COMMENTS	LOW	impoundment (incised), see App.12-E, Exh. 12-43

12.3.5 Reclamation of Diversion Structures

All temporary diversion structures will be reclaimed as per the guidelines outlined in Section 12.3, 12.5, and 12.6. The structures will be graded to the surrounding terrain, topdressed, and seeded.

Area 3 Temporary Diversion is located east of Lowe Pit and begins from the northern end of Lowe Pit traversing south and southwest towards Dixon Pit. As mining progresses to the east in Lowe Pit, this temporary diversion will eventually be mined through. The southern half of the temporary diversion will be mined through by the year 2005 according to the current mine plan. The northern section will be mined out by the year 2021. Thereafter, the area will be reclaimed to the FSC.

Lowe Dixon Diversion is along the eastern lease boundary of Area 3 east of Lowe Pit going from north to south. This diversion will be mined through in the year 2011 according to the current mine plan. The area will be regraded to the FSC and reclaimed after mining ceases in this area.

12.3.6 Reclamation of Other Support Facilities

Upon completion of mining, the mine support facilities will become the property of the Navajo Nation, as specified in Navajo Mine's lease agreement. Any facilities that the Navajo Nation does not want to maintain will be removed. Following removal, the affected areas will be regraded, topdressed, and revegetated.

12.3.7 Surface Stabilization on Post Mining Reclaimed Lands

In certain cases reclaimed areas may require designed drainage control structures in order to stabilize reclaimed lands and minimize erosion. Drainage structures for surface water control and surface stabilization on reclaimed lands, will be designed and constructed following the guidelines outlined in the Reclamation Surface Stabilization Design Handbook. As-Built designs

for control structures on permanent program lands, are provided in Chapter 12, Appendix 12-F and listed below in Table 12.3.7-1.

Table 12.3.7-1 Drainage Control Structures

Structure Name	Location	Structure Type	Comments
Lowe Corner 3 Drop Structures	NE Lowe	Highwall Drop Structure	Gabion mats and grouted rip-rap
West Lowe Drainage Control Structures	West Lowe	Ephemeral channel	Gabion and rip-rap

In addition to using drainage control structures, where appropriate and feasible, cattle may also be utilized to stabilize reclaimed land and minimize erosion. Cattle grazing will be used to impact reclaimed land to reduce erosion by incorporating mulch and seed into the soil, and increase water infiltration by creating increased surface roughness with cattle hoof action.

12.3.8 Reclamation of Ash Disposal Areas

The objective of reclamation on ash disposal areas is identical to the objective stated in section 12.1. In order to achieve that objective, the relevant reclamation methods outlined in CHAPTER 12 will be employed.

12.3.8.1 Ash Cover

Following closure of an ash disposal area, a total of three meters of material will be used to cover the ash. This three meters of cover includes all topdressing and suitable root zone materials. All reclaimed ash disposal areas will incorporate positive drainage.

12.3.9 Use of CCB in Backfilling and Grading

In specific areas of the mine, Coal Combustion By-products (CCB) will be used to achieve the FSC. The targets for ash disposal are generally final pits and ramps. The specific permanent

program lands are indicated on EXHIBIT 1-4. The use of CCB in backfilling will require disposal areas are left open which may delay regrading. Navajo Mine has no exemption for Thin Overburden or Thick Overburden.

A cut/fill material mass balance with CCB used as backfill material was calculated for Areas I and II. The CCB are used to backfill final pits and ramps, reducing the need to back haul material as fill for these areas. Note that while South Barber and Barber Ramp 4 areas are indicated as zero planned disposal yards BNCC intends to retain these as permitted CCB disposal sites against further changes to plan or increased ash volumes from FCPP. The cut/fill mass balance for Area I and Area II follows.

Cut/Fill Mass Balance

	Area I[1]	Area II
Cut Available	1,163,000 cyd	62,460,000 cyd
Fill Needed	3,087,000 cyd	76,900,000 cyd
Planned CCB	1,924,000 cyd	14,440,000 cyd

Planned CCB Disposal Volumes

Pinto Pit[1]	1,924,000 cyd
Sub Total Area I	1,924,000 cyd
South Barber Final Pit	0 cyd
Barber Ramp 4	0 cyd
North Barber Final Pit	12,440,000 cyd
Hosteen Ramp 3	2,000,000 cyd
Sub Total Area II	14,440,000 cyd

1. Area I volumes are as of July 2006.

12.3.10 Area I Alternate Sediment Control Plan

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 12.3.10 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 premine watersheds are shown on Exhibit 12-45A and the post mine are shown on Exhibit 12-45.

Selection of the pre-mine watersheds shown on Exhibit 12-45A 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 premine 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 I post-mine RUSLE input parameter of 0.23 for K. For the coarse fragment material placed as a soul 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 12.3.10. 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 I (Chapter 8, Exhibits 8-2 and 8-3) 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 premine 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 12.3.11 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 12-46 shows the post-mine watershed of the Yazzie Ramp 2 area.

TABLE 12.3.10
COMPARISON OF PRE-MINE AND POST-MINE
ANNUAL SEDIMENT YIELDS
RUSLE Ver. 1.06 PARAMETER INPUTS

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**

POST 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**

POST 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 12.3.11O
COMPARISON OF PRE-MINE AND POST-MINE ANNUAL SEDIMENT YIELDS
RUSLE Ver. 1.06

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	0.210938	0.01	0.007	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

12.4 SPOIL

12.4.1 UNCONSOLIDATED SPOIL MATERIAL

Unconsolidated spoil material may be stockpiled for future use. It is anticipated that much of the unconsolidated material will be used as road base during road construction and maintenance activities, but may be used for other purposes such as pond embankment, culvert fill, mitigation material, etc. If unconsolidated spoil material is placed in the root-zone (top 4 feet of soil/spoil) in reclamation areas, the spoil will be tested after placement to ensure it meets root zone suitability criteria.

To protect spoil stockpiles, the best available technology will be utilized. This may include the following; 1) steep slopes of 2:1 or less with a berm on the top of the pile to reduce runoff along the slopes, 2) silt fences or straw bales to filter spoil from runoff, and 3) berms around spoil stockpiles. Seeding and mulching will not be applied due to the low probability of plant establishment under the climatic and edaphic constraints at the stockpiles. After stockpiles are removed, the footprint area will be regraded to FOC and revegetated.

Currently all Unconsolidated Spoil Stockpiles are located in Area III, shown on Exhibit 11-11 Mine Structures Location Map. The stockpiles include; 1) DXR1_US - Stockpile at Dixon Ramp 1 with an estimated volume of 200,000 cyd, 2) DXEX_US - Stockpile located within the Dixon Extension area with an estimated volume of 50,000 cyd, and 3) LWR4_US_E – Stockpile located on Lowe Ramp 4 with an estimated volume of 184,000 cyd.

Approximately 55,000 cyd of material from DXR1_US will be used for the Cottonwood Crossing scheduled for completion in 2009. The remaining material will be used intermittently until the end of mining. DXEX_US will be used for the Burnham Reroute which is scheduled for completion in 2009. LWR4_US_E will also be used intermittently until the end of mining.

12.4.2 DISPOSAL OF EXCESS SPOIL

There is no disposal of excess spoil at the Navajo Mine because of the mining method used. Navajo Mine's spoil handling operations are described in Section 11.2.3. The process of backfilling each strip with spoils from the next strip eliminates excess spoil areas and allows all of the spoil to be included in the FSC. In areas where ash disposal has or will occur (i.e. Areas I and II), disposed ash volumes have been accounted for in the FSC.

12.5 TOPDRESSING

12.5.1 Topdressing Replacement

Topdressing is removed from stockpiles or taken directly from topdressing salvage areas and redistributed on regraded areas. Traffic on replaced topdressing is limited to reclamation activities to minimize compaction of topdressing materials. Prior to topdressing, the required volume of topdressing for a specific area will be determined. The appropriate volume of topdressing will then be applied to the area. If the top 12 inches of root zone material meets topsoil suitability guidelines, then no topdressing will be required for that area. When the top foot of root zone material is used as topsoil, Navajo Mine will analyze an additional foot of root zone material to ensure that the total depth of suitable material (root zone plus topsoil substitute) is five feet.

Navajo Mine will utilize one of the following methods to assure that required thicknesses of topdressing are being replaced on regraded and/or appropriately mitigated surfaces:

1. Prior to topdressing replacement, the prepared regraded/mitigated surface within each reclaimed parcel will be staked with lath on a 165-foot square grid basis. Lath will be clearly marked indicating the appropriate topdressing replacement depth on each stake. Marked lath will be visible to equipment operators to insure that appropriate thicknesses of topdressing are redistributed throughout the reclaimed parcel. Each lath will be marked on both sides to indicate proper topdressing replacement thickness for each area. A minimum of 70 percent of the lath will remain in place until an OSM inspector has verified appropriate topdressing replacement depths. If lath is removed prior to OSM inspection, then the following will be utilized to verify topdressing replacement thickness.
2. Depth of replaced topdressing will be determined using the same 330 foot fixed grid as used to monitor regraded spoil. Should a deficit of topdressing be determined at the original sample grid point then the 2.5 acre plot will be divided into 4 equal subplots using the same methodology as approved for the regraded spoil monitoring plan (see Figure 12-1 for sampling layout). Each subplot will represent 0.625 acres. Topdressing thicknesses will then

be determined at a sample point centrally located in each subplot (see Figure 12-1 for location of subplot sample points). The topdressing thicknesses will then be determined for each of the 4 subplots. Survey depths may be used in lieu of physically digging samples, in which case the depth will be determined from the difference between the before and after topdressing elevations. The average depth of topdressing will be determined from the sample points in the reclamation plot. All sample points will have a minimum sample depth of one half the required average depth for that area. If the topdressing depth is insufficient additional topdressing will be spread over the entire area the sample point represents to meet permit commitments.

After topdressing has been redistributed, it may be disced along the contour to minimize erosion and reduce compaction of the topdressing.

Annual topdressing monitoring reports shall be prepared, filed at Navajo Mine, and submitted to OSMRE on or before August 31 of each year. The annual topdressing monitoring report shall cover the reporting period from July 1 to June 30 and include the following:

1. Data analysis sheets reporting depth of topdressing from each sampling point sampled during the reporting period.
2. Confirmation of the average topdressing depth for the reclamation plot. When grade staking is used to verify topdressing replacement depths, the following information will be included in the annual report:
   a. documentation will be provided indicating the date, methods and results of field inspections conducted by OSM inspectors to verify topdressing replacement depths for each reclamation plot; and
   b. volumetrics of topdressing material respread in each reclamation plot will be provided.
3. Grid location for each sample noted on a 1:6000 (1": 500') scale map which delineates the topdressed area.

12.5.2 Topdressing Balance

CHAPTER 8, SOIL RESOURCES, contains a 1989 report that identifies all useable topdressing material to a maximum depth of 60 inches on areas projected to be disturbed. This information, combined with the volume of topdressing material in stockpiles and borrow areas, provides the total topdressing resources for Area I, II, III, and IVN (TABLE 12-4). This topdressing resources inventory will be updated on an annual basis and provided as part of the root-zone and topdressing report submitted to OSM on or before August 31.

Disturbed locations at Navajo Mine are defined as land disturbed by overburden removal for coal mining, construction associated with railroad access, and construction associated with shop and office areas. The disturbed or potentially disturbed areas identified in TABLE 12-4 includes areas, as of December 2003, that are projected to have topsoil, which will be used as part of the reclamation program. Areas that have been reclaimed or that have had topsoil placed prior to December 2003 are not included. The major locations included as disturbed are those mined but not reclaimed as of December 2003, and those areas that are scheduled to be mined after December 2003 to the lease boundary. The disturbed acreage has been determined for Areas I, II, III, and IV North.

Topdressing volumes are estimated using three different types of source information. Stockpiled volumes are estimated by aerial flight data, vehicle load counts or survey data. The volume of in situ topdressing to be salvaged just ahead of mining pits is determined by a pre-mine topdressing salvage program. This program involves conducting an intensive pre-mine survey of topdressing resources ahead of each mining pit and borrow area. The volume of topdressing material away from the active mining areas is calculated using baseline Soil Resources of Navajo Mine, CHAPTER 8.

TABLE 12-4
TOPDRESSING RESOURCES AT NAVAJO MINE
Dec 2003

Topdressing/Topdressing substitute Supply	Mine Area			
	I[4]	II[4]	III[5]	IV North
Stockpile Volumes (cyds)	914,289	540,683	1,952,024	
Insitu Topdressing (to be mined)	0	393,473	1,614,881	2,350,185
Borrow Areas (insitu not to be mined)				
Chinde Borrow Area		637,238		
North Daisy Borrow Area	588,040			
South Daisy Borrow Area				
Block A Borrow Area		409,804		
Area 3 Borrow Area				
Yazzie Y Borrow Area (pending approval)		400,000		
Hosteen Ovb. Material 350,000 cyds (@2ft. Deep will cover 110 acres)				
Insitu Regolith (to be used as topdressing)				
Stockpiled Regolith (to be used as topdressing)				
Total Topdressing Available	1,502,329	2,381,198	3,566,905	2,350,185
Topdressing Needs				
Topdressing depth(in) required by PAP	8.7	5.6	9.7	5.7
Current disturbance as of Dec. 2003 (Ac.)	715	2,251	1,863	0
Future disturbance through lease bound.(Ac.)	0	436	847	3,051
Acres covered in Area II by overburden material		-110		
Total Acres to be Topsoiled	715	2,577	2,710	3,051
Topdressing needed to reclaim remaining acres to required depths(cyds)	836,312	1,940,195	3,534,141	2,338,083
Difference	666,017	441,003	32,764	12,102

[1] Volumes represent a 10% handling loss

[2] Volumes based on Soil Resource Report Chapter 8 and Pre-strip surveys

[3] See Detailed Soils Maps exhibits in Chapter 8 Vol. 10 for stockpile and borrow area locations

[4] Figures updated Dec 2003

[5] Figures updated Dec 2003--Includes Dixon Extension area

Due to the variable nature of estimating the volume of in situ resources, a 10% handling loss was not applied to in situ material. All reclaimed lands in the permit will, at a minimum, receive an average of 5.6 inches of topdressing material.

In Area II, the available topdressing resource, from both existing topsoil stockpiles and areas of suitable topdressing to be disturbed by future mining, resulted in a calculated replacement depth on disturbed areas of approximately one inch. To increase the replacement depth to the recommended 5.6 inches, several measures will be employed. Areas of suitable topdressing material in Area II that were not scheduled for disturbance were designated as topdressing borrow areas. These areas were carefully checked by soil series to determine the depth of suitable material and the presence or absence of consolidated material. In areas with consolidated material below the topdressing profile, material will be salvaged to such a depth that at least 12 inches of suitable topdressing will be left following salvage operations. In areas with unconsolidated material below the profile, topdressing will be salvaged to such a depth that at least six inches of suitable topdressing will be left following salvage operations. This will ensure that sufficient topdressing material is retained on these borrow areas to achieve successful revegetation as outlined in Section 12.6

Current topdressing replacement depths are as follows:

Area I = 8.7″

Area II = 5.6″

Area III = 9.7″

Area IVN = 5.7”

In order to achieve these depths the following actions will occur in each mine area.

Area I

Current stockpile material will be used for revegetation on all areas. Approximately 100,000 cubic yards of material will be used from approved topdressing borrow areas to topdress interim and permitted areas to a depth of 8.7 inches. Table 12-4 provides estimated volumes of in situ topdressing resources that may be salvaged from each discrete borrow area.

Navajo Mine will notify OSM prior to disturbance of any potential borrow areas within Permanent and/or Interim Program Lands, or any combination of Interim or Permanent lands. As part of this notification process, Navajo Mine will provide an estimate of the volume of materials to be salvaged and the acreage of land designed for disturbance for the purpose of recovering sources of topdressing material.

Area II

All stockpiled, in situ, and borrow areas material will be used on interim and permitted areas. In addition regolith (which has been tested suitable as topdressing) in the Hosteen/Yazzie area will also be used as topdressing material. The total volume of these areas will result in a replacement depth of 5.6 inches. Table 12-4 provides estimated volumes of in situ topdressing resources that may be salvaged from each discrete borrow area within Area II.

Navajo Mine will notify OSM prior to disturbance of any potential borrow areas within Permanent and/or Interim Program Lands, or any combination of Interim or Permanent lands. As part of this notification process, Navajo Mine will provide an estimate of volume of materials to be salvaged and the acreage of land designed for disturbance for the purpose of recovering topdressing material.

Area III

Table 12-4 provides estimated regolith volumes in the Dixon area to be used as topdressing material.

Area IV North

All in situ material will be used in revegetation of the area. Table 12-4 details the available resources and the number of acres to be reclaimed.

12.6 REVEGETATION PLAN

The postmining revegetation plan has been designed to establish a diverse, stable and self-sustaining vegetation that will satisfy the following criteria:

1. Adequate cover capable of stabilizing the soil surface from erosion,
2. Adequate forage to sustain the postmining land uses (i.e. livestock grazing and wildlife habitat), and
3. Suitable species composition for enhancement of wildlife forage and cover.

No topdressing or revegetation of coal spoil fire areas will be conducted. If a coal spoil fire should begin beneath a previously revegetated plot; it will be monitored until it extinguishes itself. The area will then be assessed and, if necessary, revegetated.

Revegetated areas are shown on EXHIBITS 12-8 through 12-10.

12.6.1 Schedule

Revegetation is initiated on those areas that have been graded and topdressed (or graded if suitable overburden exists) during the first normal period for planting following the completion of grading and topdressing activities (TABLE 12-1). Revegetation activities run from March through October and include seedbed preparation, seeding, mulching, and irrigation.

Occasionally portions of a Block (total years topdressed area) may be topdressed before the end of a normal period for planting to achieve the block approach to reclamation. These blocks will not be completely topdressed until after the normal season of planting. These areas will be identified and communicated to OSM during the annual backfilling and grading schedule meeting at the 4th quarter of each year. Blocks where topdressing is started during the normal period for planting but is not complete until after the normal period for planting will be seeded during the next normal period for planting. These topdressed areas will be protected from wind and water erosion by contour disking and installing V-ditches around plot perimeters.

Fences are erected as needed to protect all revegetated areas during the first season of irrigation to eliminate grazing and unauthorized activities. These fences are patrolled and maintained throughout the year.

12.6.2 Seedbed Preparation

An essential component of a successful revegetation program is a properly prepared seedbed. Topdressing that has been redistributed on regraded areas is mechanically prepared to achieve the following benefits:

1. Reduce soil compaction caused by heavy equipment used in regrading and redistribution of topdressing,
2. Provide a transition at the interface between the spoil material and the topdressing to enhance root penetration,
3. Promote water infiltration,
4. Help control wind and water erosion,
5. Provide a firm and smooth surface for proper seed placement, and
6. Improve seed to soil contact for early seed development.

During regrading activities, certain areas become heavily compacted. This generally occurs in areas where rock trucks and scrapers are utilized for regrading. Most frequently, the heaviest compaction occurs in areas of repeated traffic (roads). These heavily compacted areas are either ripped with a dozer, blade, or disk depending on the severity of compaction. Once the spoil materials are loosened, the area is smoothed by a blade for topdressing placement.

Once topdressing is placed, the area is again disked to alleviate compaction. The severity of the compaction, depth of topdressing, and the texture of the topdressing determines the type and number of seedbed operations utilized. For example, if a large 36-inch disc is required to break

through deep, heavily compacted, and heavy-textured topdressing, it will generally leave deep furrows and large clods. If this occurs, a second disking is required utilizing a smaller disk and/or roller harrow to smooth and firm the surface of the topdressing/seedbed. Rough seedbed surfaces are less effective for seeding since seeders are designed to place different seeds at their optimum seeding depth in smooth, firm seedbeds.

Additional preparation practices include contour furrowing and contour ditching. See CHAPTER 11, Section 11.6.4 for specifics on designs and reclamation areas. For either of these operations to work effectively, the furrows and ditches have to be exactly on the contour. With undulating micro-topographies and equipment limitations, this was operationally impossible, and water therefore collected in the low spots breaching the furrows and ditches. This breaching usually continues down the slope from one furrow/ditch to the next creating an uncontrollable eroding channel. This has become a continuous problem in all the existing reclaimed areas requiring repeated repair efforts with little long-term success.

12.6.3 Seed Mixture

Since 1975, the seed mix (species and amounts) has been the subject of extensive research. Generally, the number of species seeded has increased since the first seedings, while the seeding rates (pounds of pure live seed planted) have decreased. The seeding rate is the subject of continual investigation to determine its impact on revegetation success.

In November 1999, Navajo Mine altered seed mixtures due to modifications in the revegetation success standards. The original general seed mix was replaced with three specialized seed mixtures, which include 1) Cool Season Mix, 2) Warm Season Mix, and 3) Shrub Mix. A copy of the original seed mixture will remain in the permit (Table 12-5) for historical reference.

Each specialized seed mix will be applied to a specific reclaim area based on several factors including, soil temperature, planting season and topography. Reclaiming with specialized seed mixtures will increase species diversity over the entire mine and reduce the competition between

species within a given mix. Each seed mixture is designed to emphasize the establishment of assorted species based on natural differences in germination requirements.

The original seed mix had a total of 17 different species. The new mixtures have a maximum of 14 different species per mix. Having fewer species within a single mix will reduce the between species competition. The three specialized seed mixtures have a combined total of 21 different species. Applying three specialized seed mixtures over the mine will reduce the amount of competition between species within a given seed mixture but at the same time will increase the total number of different species being seeded over the entire mine.

The three specialized seed mixtures have a total of ten grasses species, four forbs, and seven shrub species (21 total). There are also six additional species identified as substitutes, which may replace a given species as needed.

The following are general characteristic of each of the specialized seed mixtures.

Cool Season Mixture

This mixture has 14 species; 8 grasses, 3 forbs, and 3 shrub species (TABLE 12-5A). Most species in this mix are characterized as "cool" season species and have best germination results in cooler temperatures. This mixture will mainly be applied when daytime soil temperatures are less than 60° Fahrenheit, in early spring or late fall.

Warm Season Mix

This mixture has 13 species; 5 grasses, 4 forbs, and 4 shrub species (TABLE 12-5B). Most species in this mix are characterized as "warm" season species and have best germination results in warmer temperatures. This mixture will mainly be applied when daytime soil temperatures are greater than 60° Fahrenheit (late spring through summer).

Shrub Mix

This mixture has a total of 14 species; 5 grasses, 2 forbs and 7 shrub species (TABLE 12-5C). The species seeding ratios are designed to enhance wildlife cover by establishing "shrub islands". This seed mix will be applied through out the seeding window to drainage's or small basins where water may accumulate. This mix will be applied conservatively to areas with desirable topography at the operator's discretion.

Changes in the overall species composition are summarized as follows:

Common Name	Scientific Name	Form	Comments
Prairie Aster	Aster tanacetifolius	Forb	Removed from Mix 11/1999
Blue Flax	Linum lewisii	Forb	Removed from Mix 11/1999
Rocky Mtn. Penstemon	Penstemon strictus	Frob	Removed from Mix 11/1999
Thickspike Wheatgrass	Agropyron dasystachyum	Grass	Added to Mix 11/1999
Prairie Junegrass	Koeleria cristata	Grass	Added to Mix 11/1999
Bottlebrush Squirreltail	Sitanion Hystrix	Grass	Added to Mix 11/1999
Mat Saltbush	Atriplex Corrugata	Shrub	Added to Mix 11/1999
Douglas Rabbitbrush	Chrsothamous vicidiflorus	Shrub	Added to Mix 11/1999
Greasewood	Sarcobatus vermiculatus	Shrub	Added to Mix 11/1999
Prairie Sage	Artemisia Ludoviciana	Forb	Added to Mix 11/1999
Evening primrose	Oenothera pallida	Forb	Added to Mix 11/1999
Palmer Penstemon	Penstemon palmeri	Forb	Added to Mix 11/1999D
Castle Valley Clover	Atriplex Cuneata	Shrub	Added as substitute species 11/1999
Sulfur Flower	Eriogonum Umbellatum	Forb	Added as substitute species 11/1999
Nelson Globemallow	Sphaerealcea parvifolia	Forb	Added as substitute species 11/1999
Munro Globemallow	Sphaerealcea munroana	Forb	Added as substitute species 11/1999
New Mexico Needle grass	Stipa neomexicana	Shrub	Changed to a substitute species
Rubber Rabbitbrush	Chrysothamnus nauseosus	Shrub	Changed to a substitute species

These species are native to the San Juan Basin, which accounts for their ability to survive the soils and climatic conditions of the mine area. The herbaceous species provide nutritional qualities during the growing season, and the palatable shrubs such as four-wing saltbush, shadscale, and winterfat provide good nutritional qualities throughout the year. Three non-palatable shrubs used in the seed mix, ephedra, greasewood, and rabbitbrush, provide cover for small mammals and passerine birds.

Navajo Mine will continue to investigate possible modifications to cultural practices (including irrigation practices) with the intent to enhance cover production and diversity of revegetation.

When such trials involve altering the above seed mixture the regulatory authority will be consulted.

Subject to seed availability, the species listed in TABLE 12-5A,B and C will be used at Navajo Mine. The quantities of pure live seed (PLS) used per acre and corresponding numbers of seeds per square foot will vary somewhat depending on seed availability, soil texture, topographic conditions and habitat features to be seeded. To ensure that good quality seed is used, state certified standards outlined under the Federal Seed Act will be followed.

Research on other species that are adapted to the mine area and are considered to be compatible with the postmine land use is continuing at the Navajo Mine. Should other species indicate suitability for revegetation and compatibility with the postmining land use, they will be added to the seed mixture in quantities deemed appropriate. If an introduced species demonstrates adaptability and utility for reclamation use, approval of the regulatory authority will be obtained before the introduced species is included in the seed mix.

TABLE 12-5

ORIGINAL NAVAJO MINE RECLAMATION SEED MIXTURE APPLIED 1975 - 1999

SPECIES: Common Name	Scientific Name	Seeding method/ Seed Group	Seeding Depth	Ave. # of Seeds/lb	Seeding Rate Ave. PLS lb/ac	PLS/sq. ft
Alkali Sacaton	*Sporobolus airoides*	B/B	<1/4"	1,758,000	0.04	1.61
Blue Grama	*Bouteloua gracilis*	D/F	¼"-1/2"	825,000	0.25	4.73
Galleta	*Hilaria jamesii*[1]	D/LS	1/2"- 1"	470,000	0.25	2.70
Giant Dropseed	*Sporobolus giganteus*	B/B	<1/4"	1,723,000	0.10	3.96
Indian Ricegrass	*Oryzopsis hymenoides* [2]	D/LS	3"- 6"	141,000	1.00	3.24
Needle and Thread	*Stipa comatai*[3]	D/F	¼"-1/2"	115,000	0.50	1.32
Sand Dropseed	*Sporobolus cryptandrus*	B/B	<1/4"	5,298,000	0.10	12.16
Western	*Agropyron smithii*	D/LS	1/2"- 1"	110,000	0.80	2.02
Fourwing Saltbush	*Atriplex canescens*	D/LS	1/2"- 1"	52,000	1.20	1.43
Mormon Tea	*Ephedra viridis.*	D/LS	1/2"- 1"	19,000	0.08	0.03
Rubber Rabbitbrush	*Chrysothamnus*	D/F	¼"-1/2"	400,000	0.25	2.30
Shadscale	*Atriplex confertfolia*	D/LS	1/2"- 1"	64,900	1.00	1.49
Winterfat	*Ceratoides lanata*	B/B	<1/4"	56,700	0.75	0.98
Prairie Aster	*Aster tanacetifolius.*	B/B	<1/4"	500,000	0.02	0.23
Blue Flax	*Linum lewisii*	B/B	<1/4"	293,000	0.03	0.20
Globemallow	*Sphaeralcea*	D/F	¼"-1/2"	500,000	0.03	0.34
Rocky Mtn.	*Penstemon strictus*	B/B	<1/4"	592,000	0.02	0.27
TOTAL:					6.42	39.02

[1] Caryopsis will be used when available.
[2] Oryzopsis hymenoides is seed separately in sandy topdressing.
[3] Stipa neomexicana may be substituted when available.

Seeding method B = Broadcast, D = Drilled.
Seed Group Seeds are separated into groups; B = Broadcast group, F = Fluffy seed, LS = Large smooth seed.

TABLE 12-5A

COOL SEASON RECLAMATION SEED MIXTURE[3]

Common Name	SPECIES: Scientific Name	Seeding method/ Seed Group	Seeding Depth	Ave. # of Seeds/lb.	Seeding Rate Ave. PLS lb./ac	PLS/sq. ft
Thickspike Wheatgrass	*Agropyron dasystachyum*	D/LS	1/2"- 1"	154,000	0.75	2.65
Blue Grama	*Bouteloua gracilis*	D/F	¼"-1/2"	825,000	0.15	2.84
Galleta	*Hilaria jamesii*[1]	D/LS	1/2"- 1"	470,000	0.15	1.62
Prairie Junegrass	*Koeleria cristata*	B/B	<1/4"	2,315,400	0.05	2.66
Indian Ricegrass	*Oryzopsis hymenoides* [2]	D/LS	3"- 6"	141,000	1.50	4.86
Bottlebrush Squirreltail	*Sitanion hystrix*	D/LS	1/2"- 1"	192,000	0.50	2.20
Alkali Sacaton	*Sporobolus airoides*	B/B	<1/4"	1,758,000	0.04	1.61
Needle and Thread	*Stipa comata*	D/F	¼"-1/2"	115,000	0.20	0.53
Fourwing Saltbush	*Atriplex canescens*	D/LS	1/2"- 1"	52,000	1.20	1.43
Shadscale	*Atriplex confertfolia*	D/LS	1/2"- 1"	64,900	1.00	1.49
Winterfat	*Ceratoides lanata*	B/B	<1/4"	56,700	1.30	1.69
Evening Primrose	*Oenothera pallida*	D/LS	1/2"- 1"	512,000	0.30	3.53
Palmer Penstemon	*Penstemon palmeri*	B/B	<1/4"	210,000	0.40	1.93
Globemallow	*Sphaeralcea grossulariaefolia.*	D/F	¼"-1/2"	500,000	0.30	3.44
				TOTAL:	7.84	32.48

[1] Caryopsis will be used when available.
[2] Oryzopsis hymenoides is seed separately in sandy topdressing.
[3] Seed mixture established November 1999.

Seeding method B = Broadcast, D = Drilled.
Seed Group Seeds are separated into groups; B = Broadcast group, F = Fluffy seed, LS = Large smooth seed.

TABLE 12-5B

WARM SEASON RECLAMATION SEED MIXTURE[2]

Common Name	SPECIES: Scientific Name	Seeding method/ Seed Group	Seeding Depth	Ave. # of Seeds/lb.	Seeding Rate Ave. PLS lb./ac	PLS/sq. ft
Blue Grama	*Bouteloua gracilis*	D/F	¼"-1/2"	825,000	0.30	5.68
Galleta	*Hilaria jamesii*[1]	D/LS	1/2"- 1"	470,000	0.30	3.24
Alkali Sacaton	*Sporobolus airoides*	B/B	<1/4"	1,758,000	0.04	1.61
Sand Dropseed	*Sporobolus cryptandrus*	B/B	<1/4"	5,298,000	0.05	6.08
Giant Dropseed	*Sporobolus giganteus*	B/B	<1/4"	1,723,000	0.10	3.96
Fourwing Saltbush	*Atriplex canescens*	D/LS	1/2"- 1"	52,000	0.75	0.90
Winterfat	*Ceratoides lanata*	B/B	<1/4"	56,700	1.50	1.95
Douglas Rabbitbrush	*Chrsothamous vicidiflorus*	D/F	¼"-1/2"	782,000	0.30	5.39
Greasewood	*Sarcobatus vermiculatus*	D/LS	1/2"- 1"	210,000	0.40	1.93
Prairie Sage	*Artemisia ludoviciana*	B/B	<1/4"	4,500,000	0.05	5.17
Evening Primrose	*Oenothera pallida*	D/LS	1/2"- 1"	512,000	0.45	5.29
Palmer Penstemon	*Penstemon palmeri*	B/B	<1/4"	210,000	0.40	1.93
Globemallow	*Sphaeralcea grossulariaefolia.*	D/F	¼"-1/2"	500,000	0.30	3.44
				TOTAL:	4.94	46.57

[1] Caryopsis will be used when available.
[2] Seed mixture established November 1999.

Seeding method B = Broadcast, D = Drilled.
Seed Group Seeds are separated into groups; B = Broadcast group, F = Fluffy seed, LS = Large smooth seed.

TABLE 12-5C

HIGH SHRUB RECLAMATION SEED MIXTURE[2]

Common Name	SPECIES: Scientific Name	Seeding method/ Seed Group	Seeding Depth	Ave. # of Seeds/lb.	Seeding Rate Ave. PLS lb./ac	PLS/sq. ft
Thickspike Wheatgrass	*Agropyron dasystachyum*	D/LS	1/2"- 1"	154,000	0.20	0.71
Blue Grama	*Bouteloua gracilis*	D/F	¼"-1/2"	825,000	0.08	1.52
Galleta	*Hilaria jamesii*[1]	D/LS	1/2"- 1"	470,000	0.15	1.62
Bottlebrush Squirreltail	*Sitanion hystrix*	D/LS	1/2"- 1"	192,000	0.20	0.88
Alkali Sacaton	*Sporobolus airoides*	B/B	<1/4"	1,758,000	0.02	0.81
Fourwing Saltbush	*Atriplex canescens*	D/LS	1/2"- 1"	52,000	1.00	1.19
Shadscale	*Atriplex confertfolia*	D/LS	1/2"- 1"	64,900	1.50	2.23
Mat Saltbush	*Atriplex corrugata*	D/LS	1/2"- 1"	60,000	0.75	1.03
Winterfat	*Ceratoides lanata*	B/B	<1/4"	56,700	1.70	2.21
Douglas Rabbitbrush	*Chrsothamous vicidiflorus*	D/F	¼"-1/2"	782,000	0.30	5.39
Mormon Tea	*Ephedra viridis.*	D/LS	1/2"- 1"	19,000	0.10	0.04
Greasewood	*Sarcobatus vermiculatus*	D/LS	1/2"- 1"	210,000	0.50	2.41
Evening Primrose	*Oenothera pallida*	D/LS	1/2"- 1"	512,000	0.25	2.94
Globemallow	*Sphaeralcea grossulariaefolia.*	D/F	¼"-1/2"	500,000	0.20	2.30
TOTAL:					6.95	25.28

[1] Caryopsis will be used when available.
[2] Seed mixture established November 1999.

Seeding method B = Broadcast, D = Drilled.
Seed Group Seeds are separated into groups; B = Broadcast group, F = Fluffy seed, LS = Large smooth seed.

12.6.4 Planting and Seeding Methods

Following seedbed preparation, seeding is accomplished by either broadcasting or rangeland seed drilling. These seeding methods are designed to plant each species at their optimum depths. Optimum planting depths for each seeded species is reported in Table 12-5A, B and C. These depths have been determined using documentation prepared by the USDA-Soil Conservation Service, Plant Material Center and through field observation with site specific conditions at Navajo Mine.

Seeded species are separated into three groups to improve distribution and ensure that each species is being planted at its optimal depth. The three group are as follows:

Broadcast Seed Group: These are small seeds which germinate best on the surface or less than ¼" deep.

Fluffy Seed Group: These are seeds with hairy or bristly appendages on the seed coat. This group is contained in a separate seed box on the seed drill. This seed is drilled to depth of ¼" - ½".

Large Smooth Group: These are seed drilled between ½" - 1". This seed is also contained in its own seed box on the drill. The seed drill is equipped with depth bands to ensure proper seeding

depth and packer wheels to ensure better seed soil contact. When the topdressing is dry and powdery the area may pre-irrigated to improve the tilth of the soil.

Hand seeding will be used, occasionally, on areas where slopes are considered too steep for the safe operation of seed drilling equipment. Whenever possible, seeding is done along the contour of the land.

Seeds of shrubs will be hand broadcast around rock piles to promote the establishment of shrubs and to increase wildlife habitat diversity.

12.6.5 Mulching and Crimping

Navajo Mine utilizes mulch primarily as an erosion control tool during periods in which plants are established. Other advantages of mulch are as follows:

1. Slows evaporation at the surface of the soil,
2. Promotes better water infiltration,
3. Decreases surface wind velocity and soil crusting, and
4. Provides an organic base (carbon) for re-establishing a beneficial microbial population, and therefore promoting nutrient cycling.

The mulch used at Navajo Mine is primarily native grass which generally consists of:

1. Native bluestem (*Androgogon gerardi*),
2. Slender wheatgrass (*Agropyron trachycaulum*), and
3. Basin wildrye (*Elymus cinereus*).

The mulch is procured in large round bales that yield noncrushed stems and leaves for ease in application and for optimum tacking of the topdressing. A round bale Haybuster is used to apply 2.0 to 2.5 tons of mulch per acre. Once the mulch is applied, it is mechanically crimped into the soil. All crimping is done on the contour when practical.

In actual field operation, Navajo Mine's mulching and crimping program has proved to be far superior in controlling erosion than contour trenching and contour furrowing. A good quality mulch, crimped properly on the contour, will anchor topdressing far beyond plant establishment. Under an irrigation program, plant establishment is much faster than mulch decomposition. As discussed in Section 12.6.2, contour ditching and contour furrowing have led to some very severe erosional problems which have required repeated repair efforts with little long-term success. For these reasons, Navajo Mine will utilize the prescribed mulching operation to limit contributions of sediment to stream flow outside the permit area.

12.6.6 Irrigation

Early research at the mine showed that supplemental irrigation was required to produce uniform stands of vegetation in a reasonable period of time. Because large scale revegetation operations using irrigation had never been practiced in northwestern New Mexico when research at Navajo Mine began, there were many unanswered questions concerning application rates, scheduling, and the proper system for applications. Several research projects between 1972 and 1974 led to the basic procedures which were initiated in 1975.

From 1975 through 1978, an aluminum irrigation system was moved by hand across each revegetation site. Concurrent research led to the present procedure of irrigating through a solid-set system. This system allows for better timing and scheduling and has led to more efficient water use without adverse effect on seed germination and vegetation establishment. Research on methods for reducing water use has been, and will continue to be, an important aspect of the work at the Navajo Mine (Aldon. 1975). Water is a vital resource in the region and reducing its use, without effecting the quality of revegetation is one of the main goals of the Navajo Mine revegetation program.

12.6.6.1 Irrigation Timing and Scheduling

Irrigation is applied as needed from May to mid-October. The irrigation system utilizes various sizes of aluminum pipe to cover the reclaim plot.

The irrigation schedule for the first growing season is divided into two parts: the germination cycle and support cycle. The goal of the germination cycle is to achieve field moisture capacity to over come seed inhibition and initiate germination. The germination cycle begins immediately after mulch application. Irrigation is applied for 5.0 hours at 55 PSI (within the lateral pipes) which is equivalent to 0.10 acre-feet or 1.15 inch application. This 5.0-hour application rate is repeated every fourth day for thirteen days, supplying a total germination application of 4.6 inches. Sprinkler head pressure is monitored using a pressure gauge with a Pitot tube attachment. This gradual application allows water to penetrate deep into the soil profile and slowly reach its field moisture holding capacity.

Following the thirteen day germination cycle the support cycle is initiated. The support cycle applies irrigation for 2.5 hours at 55 PSI, which is equivalent to 0.05 acre-feet or 0.57 inch application. This 2.5-hour application is repeated every eleven to thirteen days, depending on soil texture and environmental conditions. The support cycle continues through mid October. Soil moisture is retained longer during the cooler weather in September and October resulting in a reduced frequency of application. Soil moisture is continually monitored to determine the exact timing of irrigation. The occurrence of natural precipitation will decrease irrigation application accordingly.

Irrigation is discontinued by the third week in October as hard freezing frequently occurs. The irrigation pipe system is drained to avoid water freezing damage and left in place on the revegetated areas over the winter.

Reclaim plots may receive light irrigation during the second growing season. The goal of the second year irrigation is to continue promoting strong root development. The second year irrigation is generally a one time application scheduled in April or May. Irrigation is applied for 5.0 hours at 55 PSI, which is equivalent to a 1.15 inch application. During drought periods additional irrigation may be applied in June or July depending on environmental conditions such as temperature and total precipitation. During years of unusually high winter and/or spring precipitation, the second year irrigation is reduced or may be unnecessary. Reclaim plots are not irrigated during the third growing season.

12.6.7 Pest and Disease Control

Currently no pest or disease controls are implemented on revegetation plots at Navajo Mine. If such practices become necessary, the regulatory authority will be notified prior to implementation.

12.6.7.1 Noxious Weed Control Plan

Navajo Mine is committed to preventing the introduction and spread of noxious weeds. The introduction of noxious weeds is reduced by using reclamation seeds from licensed and reputable dealers. Emphasis is also placed on using grass-hay mulch from credible producers which is free of noxious weed seed. Farms which produce mulch for Navajo Mine are visited regularly by mine personnel to inspect field for noxious weeds.

All reclaim areas are monitored informally and formally on a regular basis. If noxious weeds are encounter during monitoring, proper action will be taken as outlined in the BIA's Navajo Area Noxious Weed Program. The BIA's weed list is not included in the permit as it is regularly updated. A copy of the current updated Noxious weed list will be on file at Navajo Mine.

Navajo Mine will implement recommendations and procedures for managing noxious weeds, according to the BIA's Noxious Weed Management Program. The BIA has compiled a list of primary and secondary weed species of greatest concern in the local area. A rating is given to each species along with an emphasis for the level of management recommended for each rating. Species are rated as follows:

A- Potential invaders: These are noxious weeds as yet not found on the reservation, but the potential for invasion is imminent. Examples: leafy spurge and Dalmation toadflax. Emphasis will be placed on prevention, education, awareness, identification and monitoring.

B- New invaders: New noxious weed known to have invaded isolated locales on the reservation. Example: diffuse knapweed. chickory, and spiny cocklebur. Emphasis is placed on immediate

control, prevention of seed spread and eradication, education, awareness, identification, control and monitoring will be the priorities.

C- Established noxious weeds: These are weeds that are wide spread and well established on the reservation that rank high on the economic impact criteria but control effort is costly. Management is limited to awareness. Emphasis is placed on management, education, awareness, identification and monitoring

12.6.7.2 Revegetation of Mining Features and Facilities

Revegetation will occur on areas such as topsoil stockpiles, ponds, diversions, roads, railroads and any other mine facilities when the feature in question is removed and the area is restored to FSC. The area will be ripped and disked as needed and reclaimed using normal reclamation procedures outlined in this section 12.6.

12.6.8 Measures to Determine the Success of Revegetation

The primary goal of revegetation success is to ensure that reclaimed areas are capable of supporting the post-mining land use of livestock grazing and wildlife habitat. Reestablishing all pre-mining plant communities after mining is not practical. Consequently, revegetation efforts were designed to establish plant communities capable of meeting the approved post-mining land requirements. The eight pre-mine plant communities and percentages of area they covered are presented in TABLE 12-6. A post-mining comparison to these communities will be used to demonstrate our revegetation success.

The range site reference areas to be used for determining revegetation success, for both cover and production, shall include only the alkali wash, arroyo shrub, and Alsan (i.e., the combined calcareous sands, sands, and saline sands) range sites. The cover and production revegetation standards shall be the equally weighted averages of the respective cover and production values for each of the range site reference areas.

These revegetation success criteria only apply to permanent program lands, and not to initial/interim and pre-law lands.

The program to determine revegetation success at Navajo Mine has the following goals:

- Identify native plant communities that represent the various pre-mine plant communities, then manage and use them as reference areas
- During the last two years of bond responsibility, sample both the reclaimed areas and the reference areas
- Compare the reclaimed areas to the reference areas to ensure they are equal to, or better than the reference areas
- Release the successfully reclaimed areas back to the Navajo Nation, so the land can be put back into productivity

TABLE 12-6

Range Site / Community Identification

BHP Navajo Mine	Bureau of Indian Affairs (BIA)	Soil Conservation Service (SCS)	Percent of Area [1]
Alkali Wash	Badlands	Sodic Slopes, Loamy	31.2 %
Arroyo Shrub	Saline Lowlands	Loamy	01.7 %
Badlands	Shaley Saline, Badlands	Sodic Slopes	27.7 %
Calcareous Sands [2]	Calcareous	Sandy, Limy	02.7 %
Dunes	Choppy Sands	Deep Sands	05.5 %
Sands [2]	Sandy, Sands	Limy	10.7 %
Saline Sands [2]	Sandy Saline	Limy, Sandy	10.1 %
Thinbreaks	Thinbreaks	Shallow	10.4 %

[1] % of Native communities obtained from CHAPTER 9, TABLES 9-1 and 9-2.
[2] For 1996 and future comparison, the three sandy communities were combined into one sand community (ALSAN).

EXHIBIT 12-29 identifies the reference areas in the permit area including approximate acreage. Reference CHAPTER 9, EXHIBITS 9-1A through 9-1F for mine wide vegetation community delineation not shown on EXHIBIT 12-29.

The reference areas were primarily selected based on intact contiguous size, similarity in plant composition to pre-mine vegetation communities, likelihood of no future impact, and ability to control grazing similar to the reclaimed areas. Five of the pre-mine communities were selected with the three sandy communities (CASA, SA and SASA) combined into one community (ALSAN).

The Calcareous Sands, Saline Sands, and Sands range sites have been combined into a single range site, Alsan, for evaluation of revegetation success. This consolidation is based on the similarity of baseline soils and vegetation information. All three range sites are dominated by soil series that are classified as coarse or fine loamy, mixed, mesic, Typic Haplargids formed from either eolian or alluvial material. Common soil series include the Bacobi and Monierco, Blancot, Redlands variant, Shiprock, Mayqueen-Shiprock, and Razito. The plant communities are dominated by the perennial grasses *Sporobolus airoides* (Alkali sacaton), *Oryzopsis hymenoides* (Indian ricegrass) and *Hilaria jamesii* (Galleta) and perennial shrubs *Atriplex confertifolia* (Shadscale) and *Gutierrezia sarothae* (Broom snakeweed). Because of the limited differences between the soils and plant communities on these range sites consolidation of these communities is appropriate.

Baseline information contained in the PAP including geology, soils, slope, aspect, and vegetation demonstrate the reference areas are representative of the pre-mine areas. Soil type, precipitation, slope and elevation are predominant factors in the development of vegetation communities at Navajo Mine. With Navajo Mine covering a relatively small geographical area with little change in elevation or precipitation, the soils play a leading role in determining the different vegetation

communities. The reference areas have the same soil mapping units as the disturbed areas did before mining; consequently, the vegetation communities are the same for both areas. The reference areas were part of the initial baseline soils and vegetation mapping and survey. More detailed information on geology can be found in Chapter 5, Permit NM-0003E and Chapter 11, Permit NM-0003C. More detailed information on soils can be found in Chapter 8, Permit NM-0003E and Chapter 18, Permit NM-0003C. More detailed information on vegetation can be found in Chapter 9, Permit NM-0003E and Chapter 16, Permit NM-0003C.

The reference areas will be fenced to exclude livestock from grazing. This will occur after obtaining all appropriate approvals. All reference areas will be fenced to exclude livestock grazing until the regulatory authority (RA) approves a grazing plan.

All areas will be posted as reference areas and managed similar to the reclaimed areas to which they will be compared. To similarly manage the reference areas, grazing plans for the reference area and reclaimed areas will be submitted to the RA for approval before grazing. Utilization studies will be conducted on both the reference areas and the reclaimed areas to determine actual utilization. Through this process, the reference areas will be grazed with similar intensity, livestock and duration as the reclaimed areas. Any reference area that needs additional rest before grazing will receive deferred grazing as approved in the grazing plan submitted to the RA.

In the event that future mining related activity impact the current reference areas, Navajo Mine has identified potential reference areas off lease/permit that could replace areas impacted or disturbed. If necessary, BHP will commence discussions with appropriate permittee(s) and agencies about obtaining right of entry to those sites. Before disturbing any reference area, BHP will discuss the disturbance and replacement of reference areas with the RA.

Vegetation sampling for bond (responsibility) release will be conducted during the last two consecutive years of the bonding period. The earliest any bond release sampling will occur on permanent program lands will be nine years after the last augmented seeding, fertilizing or

irrigation. This will allow the reclaimed area to be sampled in years nine and ten for subsequent release after year ten. Depending on location, and site conditions, reclaimed areas may not be sampled at the earliest opportunity.

Revegetation success criteria will include vegetation cover, productivity, shrub density, and species diversity. For final responsibility release, a reclaimed area (sampling unit) will meet each of the revegetation success criteria in at least two successive years. Reclaimed areas eligible for bond release sampling may be combined into a single sampling unit. Justification for combining reclaimed areas may include, but are not limited to:

- Adequate sampling area
- Seed mix used
- Proximity to one another
- Availability of water in a proposed release area
- Logical grazing blocks
- Similar appearance

Before conducting any bond release sampling, the areas to be combined for sampling will be discussed with the RA. The same sampling procedures will be used on reference and reclaimed areas. Sample locations in each area will be selected using randomly generated grid coordinates overlain on a map, computer generated point locations, or some other appropriate randomization method. Sampling will be conducted according to the following criteria:

- The following three pre-mine reference area range sites will be sampled for cover data: Alkali Wash, Arroyo Shrub and Alsan (combination of Calcareous Sands, Sands and Saline Sands). This data will be compared to the data from the reclaimed plot. These range sites were chosen for comparative purposes due to their similarity to the type of communities being reclaimed.
- Randomly located 50 meter cover transects will be used. At each half meter along the 50 meter transect, a laser pointer mounted on a tripod will be used to intersect the transect line. The first item the laser hits will be recorded (i.e., annual plant, perennial plant litter, rock, bare

ground). Each 50 meter transect is considered to be one sample point. Data will be reported by species in absolute and relative percent vegetation cover.

- Production of herbaceous and shrub species will be clipped from a ten centimeter wide by ten meter long plot which is adjacent to each transect line. Each clipped plot will start at the zero meter mark and run ten meters down the 50-meter transect line. The dominant species in each community will be clipped and bagged separately.
- Based on the 1985 baseline cover data the dominant species for each reference area range site follow:

  Alkali Wash: *Sporobolus airoides, Hilaria jamesii, Atriplex corrugata, and Atriplex obovata.*

  Arroyo Shrub: *Oryzopsis hymenoides, Chrysothamnus nauseosus, and Sarcobatus vermiculatus.*

  Alsan: (combination of Calcareous Sands, Sands and Saline Sands) *Oryzopsis hymenoides, Sporobolus airoides, and Hilaria jamesii.*

The dominant species in the reclaimed areas will be the three perennial species with the highest percent cover as identified from previous sampling of the reclaimed areas. Before sampling for final bond release BHP will present applicable data and seek the RA's approval of the dominant species on reclaimed land. The remaining perennial species in the reference area and the reclaimed areas will be harvested by life form. The life forms that will be clipped and included in the production calculations along with the dominant species are perennial grasses, perennial forbs and shrubs. All herbaceous biomass will be oven dried to a constant weight and recorded to the nearest 0.1 gram. Data will be reported in grams per square meter. Shrub production will be clipped and weighed, or a verifiable model that estimates shrub production based on measurable characteristics of the shrubs will be developed. Broom snakeweed (*Gutierrezia sarothrae*) and Salt Cedar (*Tamaix ramosissima*) production will not be included in the determination of revegetation production success.

- Shrub density will be measured in a belt transect one meter wide along the entire length of the 50 meter cover transect. Shrub density will be reported in number of shrubs per acre by species.

Vegetative cover and production will be considered successful when the total vegetative cover (i.e., percent cover of live plants plus litter) and total vegetative production (annual and perennial) of the reclaimed areas are not less than 90 percent of the total vegetative cover and total vegetative production of reference areas.

Revegetation success data will first be evaluated to determine if they are distributed normally. If the data approximate a normal distribution, the sample adequacy formula, $n_{min}=t^2s^2/(dx)^2$, will be used to determine if an adequate number of samples have been collected. When sampling is adequate and the data approximates a normal distribution; a one-sided, two-sample, t-test (alpha=0.1) will be used to determine if cover and production on the reclaimed lands are greater than or equal to 90% cover and production on the reference area. The two-sample t-test will use the following null and alternative hypothesis:

$$H_O: \mu_{reclaimed} \geq 0.90\ \mu_{reference}$$

$$H_A: \mu_{reclaimed} < 0.90\ \mu_{reference}$$

For shrub density, a one-sided, one-sample, t-test (alpha=0.1) will be used. If the data does not approximate the normal distribution, the RA will be consulted to identify appropriate statistical techniques to be used to evaluate the data and determine revegetation success.

Shrub density will be considered successful if the number of shrubs is greater than or equal to 190 shrubs per acre on 80% of the area and greater than or equal to 500 shrubs per acre on 20% of the area in shrub islands and corridors.

Species diversity will be determined as follows:

- At least one perennial grass species will have a relative perennial herbaceous cover value equal to or greater than five percent. A second perennial grass species will have a relative perennial herbaceous cover value equal to or greater than three percent. No one species shall account for more than 85 percent relative herbaceous cover.

- Cumulative perennial forbs on the reclaimed areas will be greater than or equal to 0.5 percent relative perennial herbaceous cover. This forb standard will be adjusted in drought years. In years when cumulative total precipitation for January through April at Navajo Mine (average of MET I and II stations) is less than or equal to 0.85 inches, the forb component will be successful if a single forb is encountered on the shrub density belts.

- In addition to the dominant shrub species there will be a minimum of 20 shrubs per acre of additional combined species.

12.6.9 Determination of Revegetation Success on Reclaimed Ash Disposal Areas

Revegetation success on ash disposal areas will be measured in the same manner used to determine success on other reclaimed areas based on their land status.

12.7 SUBSIDENCE PLAN

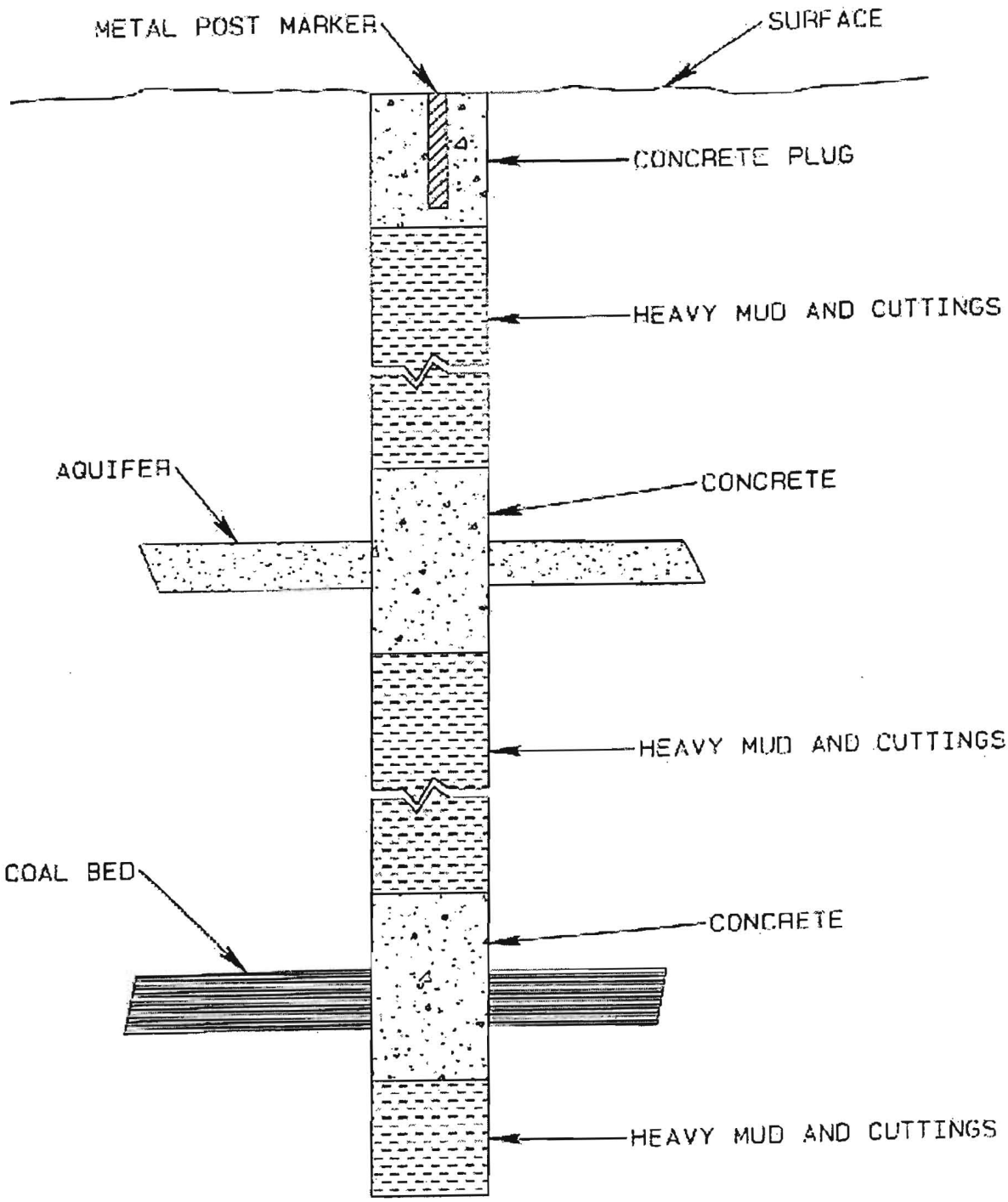
No underground mining is anticipated within the proposed permit area, and therefore, there is no subsidence monitoring. No known active or abandoned underground workings exist within 500 feet of the permit area.

12.8 CASING AND SEALING OF DRILL HOLES

Each exploration drill hole placed in areas not planned for disturbance during the permit term or placed in areas open to public or livestock access will be backfilled and sealed to eliminate hazards to people, livestock, wildlife, and machinery. The upper five feet of each exploration hole may be plugged with concrete and a metal post placed in the concrete for identification purposes. All of this is done in accordance with United States Geological Survey (USGS) Regulations covering exploration drilling.

Within the permit area any development drill holes, mine openings, bore holes, wells, or other openings will be plugged, cased, or managed.

FIGURE 12.8-1
TYPICAL DRILL HOLE SEAL/PLUG



(9/98)

12.9 DETERMINATION OF BOND

The determination of the bond is an estimation of the maximum reclamation cost that the Regulatory Authority would incur in the event of bond forfeiture by Navajo Mine during the permit term ending in 2014. Areas bonded include those areas which will be disturbed in the process of recovering coal from the permit area and those facilities that support the mine. The following costs and procedures apply only for determining the bond dollar figure at year 2014 and are not necessarily meant to represent current or future operational practices. Direct costs are calculated in Worksheets 2 through 15 and are totaled in Worksheet 16 in APPENDIX 12-B. Indirect costs are applied as percentages of the direct cost in Worksheet 16 to achieve a total bond cost.

12.9.1 Maximum Reclamation Requirements

The point at which reclamation liabilities will be greatest occurs during the first year of the five-year term ending in 2014 (see Worksheet 1, APPENDIX 12-B). The open volume of North and South Barber are at the maximum during year 1. As Hosteen and Yazzie pits progress, the final pit associated continually decreases in length.

For the purposes of this calculation, the disturbed areas have been updated with aerial flight topography and merged with the bond post mining configuration. BNCC will evaluate, and adjust if neccasry, the bond amount based on significant permit revisions, mid-term renewals, and permit renewal periods.

The amount of disturbance taking place during the permit term is primarily controlled by strip progression, which is shown on EXHIBITS 12-2 and 12-3.

Mining activities will continue in Dixon, Lowe, Barber, Hosteen and Yazzie pits. ~~Additionally, a box-cut and strip progression will commence in Area IV as seen in EXHIBIT 12-03~~. Pinto pit will be reclaimed during the permit term. Consequently Areas II and III are the primary areas for reclamation during this permit term.

12.9.2 Reclamation Costs

Reclamation costs are calculated as shown in APPENDIX 12-B, Worksheets 1 through 16. Reclamation liabilities for permit areas will occur in Areas I, II, III, and IV. It is assumed that all final bond pits will progress as scheduled as noted in EXHIBITS 12-2 and 12-3 and will be stripped to their lowest recoverable coal seam. Reclamation activities will consist of the following:

1. Facility Demolition and Removal

2. Earthmoving

3. Revegetation

4. Miscellaneous

12.9.2.1 Facility Demolition and Removal

Facility demolition and removal of all existing permit structures on the mine site includes the industrial complexes; water pipelines, intakes, and loadouts; electric power lines; explosive stores; coal facilities; water control structures; transportation facilities; and miscellaneous structures. A summary of demolition unit costs is presented in TABLE 12-B-1, APPENDIX 12-B. Most of these costs were obtained from R.S. Means software "Cost Works 2009" Version 13.0.

All permit structures are tabulated in Worksheet 2 (APPENDIX 12-B). Structure dimensions are taken from existing plans, while unit costs are from TABLE 12-B-1, APPENDIX 12-B. The resulting costs are totaled in Worksheet 16, Item 1 (APPENDIX 12-B).

12.9.2.2 Earthmoving

A post-mining "snapshot" of each Area was projected for year 2014, as shown in the Bond Post-Mining Configuration (PMC) Maps, EXHIBITS 12-11 through 12-13, 12-30a, and 12-39. The bond post mining configuration is the surface that represents the planned disturbance based on the current mine plan and has the existing disturbance area updated with aerial topography, which was designed using Earth Technology's 3D-Dig software.

To achieve Bond Final Surface Configuration (BSC) (EXHIBITS 12-14 through 12-16, 12-30b, and 12-40), PMC topography in these areas was altered to create reclaimed surfaces. The BSC surfaces maintain 6.5h: 1v maximum final interior slopes, 4h: 1v maximum outslopes, minimize backfill volumes, and ensure positive drainage as similar as possible to the Final Surface Configurations' (FSC) drainage schemes, EXHIBITS 12-4 through 12-7.

The next design step was to subtract a computerized grid of the PMC from the BSC using Maptek's Vulcan software. The result is a Cut-Fill Contours map (EXHIBITS 12-17 through 12-19 and 12-41) with the cut areas shown as red contours, and the fill areas shown as blue contours. The cut and fill areas are then subdivided into polygons and the cut and fills are balanced by taking extra cut to polygons that require fill. The result is the Cut-Fill Blocks map (EXHIBITS 12-20 through 12-23, 12-30c, and 12-36).

The Vulcan software gives the volume and centroid of each block. The centroids are used to calculate haulage distances and grades, except in the case of deep pits and ramps where haulage is assumed to be to the crest where the material can be pushed over the edge. The haulage profiles and grades are weight averaged by volume to give an average distance and grade for each equipment type for each of Areas II and III.

All bond earthmoving activities are tabulated in Worksheet 3 as follows:

Worksheet 3A	Dozers
Worksheet 3B	Trucks and Loaders
Worksheet 3C	Scrapers
Worksheet 3D	Graders
Worksheet 3E	Drilling and Blasting of Highwalls

Quantities from these worksheets are used as input to Worksheets 5 through 12 where equipment hours are calculated. Worksheet 13 uses these hours to calculate earthmoving costs. The earthmoving costs are totaled in Worksheet 16, Item 2 (see FIGURE 12-B-1, Worksheet Flow). In addition to regrade activities, earthmoving includes spoil mitigation, topsoil placement, and concrete disposal.

Once regrading and/or facilities removal activities have been completed in an area, required suitable root zone mitigation and/or topsoil material is placed on these areas. The Industrial Complexes will support all bond activities and will be reclaimed as near to the end of the project as possible.

Suitable spoil and regolith/topdressing material (either stockpiled or in situ) is used to complete the four (4) feet suitable root zone material requirements on spoil surfaces. Stockpiled and/or in-situ regolith/topdressing material is used to complete the topsoil and regolith depth requirement on all reclaimed surfaces as outlined in TABLE 12-4, (EXHIBITS 12-23 through 12-28, 12-30d, 12-30e, 12-37, and 12-38).

12.9.2.2.1 Equipment Selection

Large earthmoving equipment was selected assuming that a large contractor will be doing the reclamation work using their own equipment.

12.9.2.2.2 Equipment Productivity and Costs

Reclamation activities will take place with a 20-shift per week schedule. Equipment ownership and operating costs are tabulated in TABLE 12-B-23 taken from CRG-PRIMEDIA Equipment watch, "Cost Reference Guide for Construction Equipment", 1st half - 2009 Edition. Equipment operator wage rates are listed in TABLE 12-B-24 and were taken from the ACME Inc. Navajo Mine reclamation contract in force for 2008. The wage rates found in the aforementioned TABLE are greater than suggested wage rates provided by the Office of Navajo Labor Relations, as well as wages found for contracts for similar labor in Davis-Bacon data. To model a conservative approach, the wage rates from the previous Bond calculation (higher than such found labor rates) were unchanged and used for calculation in the total bond cost.

For haul routes greater than 500 ft, scrapers are more economical than dozers. For haul routes greater than 3,000 ft, dump trucks are more economical than scrapers. Dozers are assumed to work alone with no support equipment other than a lowboy for transport. Truck fleets require load and dump dozers, and half-time water truck and grader for haul road maintenance. Scraper fleets require one-eighth time water truck and grader for haul road maintenance. All fleets are assigned light plants for night work. Fuel and lube trucks are included in the fuel costs (TABLE 12-B-23).

Productivities for each particular activity are calculated in WORKSHEETS 5 through 12 (APPENDIX 12-B) using the material properties and haulage profile pertaining to the task.

12.9.2.2.3 Area I

Earthmoving activities for Area I will consist of those required for facilities reclamation. During the permit term, Pinto Pit will be completely regraded according to the Area I Final Surface Configuration, EXHIBIT 12-5 and EXHIBIT 12-5a.

Stockpiled topsoil will be placed on disturbed areas at a depth of 8.7 inches, as outlined in TABLE 12-4 with 2% spoil mitigation. Exhibits 12-36 through 12-41 detail the reclamation plan for Area I.

12.9.2.2.4 Area II

Ramps and pits are used as drainages and spoil material is hauled from South Barber, North Barber, and Hosteen pit and overlook to backfill open pits. In South Barber, CCB may be used to backfill the final pit as a means of contingency for the Four Corners Power Plant CCB disposal. Yazzie Pit requires additional material from the Big Fill railroad embankment and Hosteen for pit backfill. Earthmoving costs for fill material required to develop positive drainage in Permit lands is not included in the bond. Cut and Fill contours for Area II are shown on EXHIBITS 12-17 and 12-18. Area II regrade material movement is shown on EXHIBITS 12-20 and 12-21.

Material to achieve the required four (4) feet of suitable root zone material/topdressing is available in stockpiled and in-situ reserves within Area II. Additional material will be hauled as needed from Regolith stockpile(s) in Area III.

The suitable rootzone and topsoil movement consists of the mitigation of four (4) feet of suitable rootzone material over 2% of the surface area, with this four (4) foot total inclusive of the required 5.6 inches of topsoil as outlined in TABLE 12-4.

Area II suitable rootzone material movement is shown on EXHIBITS 12-26 and 12-27.

Topsoil required to achieve the 5.6 inch depth is placed over the remaining (unmitigated) disturbed surfaces in Area II. This is available in stockpile and in-situ reserves. Area II topdressing material movement is shown on EXHIBITS 12-23 and 12-24.

12.9.2.2.5 Area III

Generally, ramps and pits are used as drainages, spoil material is required from the Dixon Pit area for pit backfill in North Lowe, and Lowe boxcut material is graded to the west. Calculations for material movement and scheduling were performed without the inclusion of Dixon Box-cut Exchange. Pending negotiations with the Navajo Nation, an update will be submitted including the Dixon Box-cut Exchange.

As seen in EXHIBIT 12-13, a considerable volume of material is to be pre-stripped, or truck stripped, before dragline progression into strip DX74. For calculation purposes, this pre-strip volume was removed from the Post Mining Configuration and added to balance the Bond Surface Configuration (BSC) using Microsoft Excel. The pre-strip volume is accounted for in spreadsheet calculations, however the cut block "Dixon PS" is not shown in exhibits.

Cut and Fill contours for Area III are shown on EXHIBITS 12-19. Area III regrade material movement is shown on EXHIBIT 12-22.

Area III topdressing and spoil mitigation material movement required to achieve four (4) feet of rootzone (including 9.7 inches of topsoil) is shown on EXHIBITS 12-25 and 12-28. As with Areas I and II it is assumed that 2% of the disturbed surface areas will require mitigation. The remaining surface areas will receive only the 9.7 inches of topdressing.

12.9.2.2.6 Area IV

Ramps and pits are used as drainages and spoil material is used to backfill designed open

pits and ramps using dozer and front end loader operations. Cut and Fill contours for Area IV are shown on EXHIBIT 12-30. Area IV regrade material movement is shown on EXHIBIT 12-30c.

Material to achieve the required four (4) feet of suitable root zone material/topdressing is available in stockpile reserves in southern Area III. It should be noted that in realistic scenarios, BNCC will remove topsoil material prior to mining, and stockpile such materials for use in reclamation activities. The Bond calculations however, represent a "Worst Case Scenario", where BNCC strips without removing topsoil material. In this "Worst Case Scenario", topsoil would be hauled using trucks from Area III.

The suitable rootzone and topsoil movement consists of the mitigation of four (4) feet of suitable rootzone material over 2% of the surface area, with this four (4) foot total inclusive of the required 5.6 inches of topsoil as outlined in TABLE 12-4.

Area IV suitable rootzone material movement is shown on EXHIBIT 12-30e. Topsoil required to achieve the 5.6 inch depth is placed over the remaining (unmitigated) disturbed surfaces in Area IV. This is available in stockpile reserves in Area III. Area IV topdressing material movement is shown on EXHIBIT 12-30d. It should be noted that in realistic scenarios, BNCC will remove regolith material prior to mining, and stockpile such material for use in reclamation activities. The Bond calculations however, represent a "Worst Case Scenario", where BNCC strips without removing regolith material. In this "Worst Case Scenario", mitigation material would be hauled using trucks from Area III.

12.9.2.3 Revegetation

After backfilling the pits and ramps the bonded areas will be graded with graders and then these areas and facilities areas will be topsoiled as noted in previous sections. After topsoiling, revegetation activities will initiate. This involves seeding, crimping, mulching and irrigation. Costs are noted on APPENDIX 12-B, Worksheet 14(A-C).

12.9.2.4 Miscellaneous

A cost estimate for the riprap necessary to stabilize the reestablished drainage channels associated with the Bond Reclamation Topography was developed in APPENDIX 12-C. Channel dimensions, riprap sizes and riprap quantities were determined for channel reaches at the mine. Hydrology and channel designs are based on procedures outlined in Reclamation Surface Stabilization Design Handbook for the Navajo Mine (1999).

12.9.3 Indirect Reclamation Costs

Mobilization and demobilization costs are assumed to be 1% of the direct costs, since the reclamation project would be very large. Contingencies are 2% of the direct costs; the engineering redesign fee, the contractor profit and overhead, and the reclamation fee are set at 1.8%, 15.0% and 3.9% of direct costs respectively, per discussed agreement with OSM staff.

12.9.4 Total Performance Bond Cost

The total performance bond cost is the sum of the direct and indirect costs and is shown in Worksheet 16, APPENDIX 12-B.

TABLE 12-7

RECLAMATION BOND SUMMARY[1]

Item	Source	Amount
Total Facility and Structure Removal	Worksheet 2	$ 8,224,864
Total Earthmoving Costs	Worksheet 13	$ 99,330,498
Total Revegetation Costs	Worksheet 14	$13,527,793
Total Other Reclamation Activities Costs	Worksheet 15	$ 2,251,645
Subtotal: Direct Costs		**$123,334,799**
Mobilization and Demobilization	1.00%	$1,233,348
Contingencies	2.00%	$2,466,696
Engineering Redesign Fee	1.80%	$2,220,026
Contractor Profit and Overhead	15.00%	$18,500,220
Reclamation Management Fee	3.90%	$4,810,057
Subtotal: Indirect Costs		**$29,230,347**
Grand Total Bond Amount		**$152,565,146**

1Bond summary information can also be found in APPENDIX 12-B and 12-C, Worksheet No. 16.

Project: Navajo Mine
Date: May 2009

TABLE 12-7A
RECLAMATION BOND ADJUSTMENT SUMMARY

Item #	Item	OSM Project ID	ADJ Sum [1]	ADJ Amount
1	Bond Cost Estimate in Approved PAP (Permit Renewal)	NM0003F	1, 2, 3	$ 152,565,146
				$ 152,565,146

[1] The BHP initial reclamation bond adjustments summary sheets and worksheets are found in APPENDIX 12-B.

[2] Section 12.0 and APPENDIX 12-B established the base reclamation cost estimate in the permit renewal application.

[3] Reclamation bond adjustments summary sheets and worksheets are found in APPENDIX 12-D.

12.10 PRE-MINE TOPOGRAPHY

Area I

The Area I premine topography is shown in EXHIBIT 12-34. The northern area of the exhibit is described as a hilly terrain that primarily slopes to the southeast. The drainages in this section are either directed north off the permit site or southeast into a defined drainage system. The drainage system area is typified to be a hilly terrain featuring several mesas, sloping from the south to the north. The hilly area then transitions into a relatively flat topography which extends southward for the majority of Area I. This flat terrain divides at approximately N 2,070,000 and changes gradient from northeast to southwest. The area south of N 2,070,000 to N 2,065,000 is shown as a relatively flat topography, sloping to the northwest. The terrain then slopes down from the east and west to feature a valley directed to the south. Around N 2,057,500, the terrain then transitions into a hilly terrain that has drainages sloped west. Cross sections for the northern Area I premine topography is included in EXHIBIT 12-35. The slope histogram in Figure 12.3-1 shows a majority of the southern Area I to be in the lower slope range of 0-2.9%.

Area II

The northern section of the Area II premine topography is shown in EXHIBIT 12-34A. The northern portion of Area II is characterized to be a flat terrain, sloping to the west. This area features the Chinde Wash which enters the permit site from the southeast and exits to the northwest. The area south of the Chinde Wash is typically badland terrain and becomes a relatively flat area to the west. The flat area then transitions westerly into a hilly terrain, sloping northwest for the majority of northern Area II.

The southern half of the Area II premine topography is shown in EXHIBIT 12-34B. The northeastern portion of the exhibit is generally hilly terrain that slopes to the northwest. To the

south of the hilly area begins the badlands which run along the southeastern lease line. The hilly and badland topography transitions into a flat terrain which extends west to the permit boundary. This flat terrain slopes from the southeast to the northwest. At the south end of the exhibit, the Neck area is shown to be badland terrain that slopes to the west. The slope histogram in Figure 12.3-2 shows a majority of Area II to be in the lower to middle slope range (0-2.9% to 9-11.9%).

Area III

The Area III premine topography is shown in EXHIBIT 12-34C. The exhibit begins on the northern section as a hilly terrain trending to the west. The hilly terrain transitions to the south as a flat area with a shallow westerly grade. The majority of Area III is a flat topography that transitions at the southern end into sandstone bluff and badland terrain, tying into the Cottonwood Arroyo. The slope histogram in Figure 12.3-3 shows a majority of the Area III slope range to be in the lower category of 0-2.9%.

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12.11 HYDROLOGIC RECLAMATION PLAN.

The post mining hydrologic reclamation plan has been designed to:

- Minimize disturbances. to the extent possible, to the hydrologic balance within the permit and adjacent areas;

- To prevent material damage to the extent possible, to the hydrologic balance out side the permit area;

- To assure the protection or replacement of water rights; and

- To support the approved post mining land use.

In accordance with 780.21(h) the permit includes the components of the hydrologic reclamation plan and demonstrates compliance with 816.41 through 816.43. The preventive, remedial, or monitoring measures used to prevent to the extent possible material damage to the hydrologic balance within and outside the permit area are provided in the appropriate sections of the permit.

12.11.1 Groundwater Protection

The groundwater baseline and monitoring quality and quantity information is provided in Chapter 6 Groundwater Hydrology. The procedures used to protected the hydrogeology regime by handling materials in manner that minimizes impacts the groundwater regime is provided in Chapter 11 Operational Plan. Section 11.2, and Chapter 12 Reclamation Plan Section 12.8. The PHC prediction of impacts to the hydrogeology from mining are found in Chapter 11 Operational Plan, Section 11.6.

12.11.2 Surface Water Protection

The surface water baseline and monitoring quality and quantity information is provided in Chapter 2 Land use and Chapter 7 Surface Water Hydrology. The procedures used to protect the surface water hydrologic balance by handling materials and runoff in manner that minimizes impacts is provided in Chapter 11 (Operational Plan), Section 11.1, Section 11.2., Section 11.5, and Chapter 12 (Reclamation Plan). The PHC predictions of impacts to the surface water hydrology from mining are found in Chapter 11 Section 11.6.

12.11.3 Acid and Toxic-Forming Materials

Drainage from acid and toxic forming materials into surface water and groundwater is minimized to the extent possible by the procedures identified in Chapter 12 Reclamation Plan, Sections 12.3, 12.4, and 12.5.

12.11.4 Transfer of Wells

The procedures and criteria used for casing and sealing exploratory and monitoring wells is discussed in Chapter 12 Reclamation Plan, Section 12.8. In the event that groundwater wells are to be transferred for further use, regulatory approval will be necessary and shall comply with local, state, and federal regulations.

12.11.5 Water Rights and Replacement

The arroyos flowing through the mine permit and the livestock watering ponds found within the permit are ephemeral in nature and are usually dry most of the year. The use of these ponds and arroyos is live stock watering, but is very limited by the availability of sufficient water from precipitation events and the naturally poor quality of the runoff waters. Chapter 12 Reclamation Plan, Section 12.3.4 addresses the replacement of existing livestock watering ponds. The PHC predictions for impacts to the water resources is found in Chapter 11 Operational Plan, Section 11.6.

12.11.6 Discharges Into an Underground Mine

No underground mining is anticipated within the proposed permit area, and therefore, the potential for discharges to an underground mine do not exist.

12.12 REFERENCES

Aldon, E. F. 1975. Reclamation of Coal-Mined Land in the Southwest. Journal of Soil and Water Conservation, Volume 33, No. 2. [Permit NM-0003C, Chapter 26, page 26-16]

BHP Minerals - Navajo Mine. 1992. Reclamation Surface Stabilization Handbook.

Blaisdell J. P., R. C. Blaisdell and R. C. Holmgren. 1984. Management of Intermountain Rangelands - Salt Desert Shrub Ranges. U.S. Forest Service General Technical Report INT-16.

Buchanan, B. 1993. Spoil Quality Evaluation, Navajo Mine, BHP Minerals, Inc. Prepared by Buchanan Consultants, Ltd., Farmington, NM for Navajo Mine.

Dataquest. 1993. Cost Reference Guide. Dataquest, Incorporated.

Davis-Bacon. 1993. Wage Rates. U.S., Department of Labor, Superintendent of Documents, Government Printing Office, Washington, DC.

ENR. 1993. Engineering News Record Cost Index, McGraw-Hill Construction Weekly, New York, NY, August.

Holmgren, R. C. and S. F. Brewster, Jr. 1972. Distribution of Organic Matter Reserve in a Desert Shrub Community. U.S. Forest Service Research Paper INT-130.

Means, R. S. 1993. Means Site Work & Landscape Cost Data, 12th Annual Edition, R. S. Means Company, Inc., Kingston, MA.

Office of Surface Mining (OSM). 1988. [Revisions to the] Handbook for Calculation of Reclamation Bond Amounts, United States Department of the Interior, Office of Surface Mining Reclamation and Enforcement.

USDA-NRCS National Soil Survey Center. 1996. Soil Survey Laboratory Methods Manual, Soil Survey Investigation Report # 42 Ver. 3.0 pp. 4.