

SECTION 36

POST RECLAMATION SOIL

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SECTION 36

POST RECLAMATION SOIL

LIST OF EXHIBITS

EXHIBIT

NUMBER

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APPENDIX

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SECTION 36

POST RECLAMATION SOIL

LIST OF REVISIONS DURING PERMIT TERM

REV. NUMBER	REVISION DESCRIPTION	DATE APPROVED
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36 POST-RECLAMATION SOIL

36.1 Soil Resources

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, Section 14 – Soil.

Salvageable topdressing is the estimated amount of material that can actually be supplied to the reclaimed areas. It is predicted to be 10 percent less than what is available. This 10 percent reduction is primarily a result of handling the material several times and loss during storage.

Due to the variable nature of estimating the volume of in situ resources, a 10 percent 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 2, 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 2 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 37 – Post- Reclamation Vegetation.

Current topdressing replacement depths are as follows:

Area 1 = 8.7"
Area 2= 5.6"
Area 3= 9.7"
Area 4 North = 5.7"

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

36.1.1 Area 1

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 36-1](#) 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.

36.1.2 Area 2

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 36-1](#) provides estimated volumes of in situ topdressing resources that may be salvaged from each discrete borrow area within Area 2.

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.

36.1.3 Area 3

[Table 36-1](#) provides estimated regolith volumes in the Dixon area to be used as topdressing material.

36.1.4 Area 4 North

All in situ material will be used in revegetation of the area. [Table 36-1](#) details the available resources and the number of acres to be reclaimed.

36.2 Spoil

36.2.1 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 3, shown on Exhibit 22-3 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. These stockpiles will be intermittently utilized until they are depleted.

36.2.2 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 20 – Operations Plan. 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 1 and 2), disposed ash volumes have been accounted for in the FSC.

36.3 Topsoil 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 34-7. 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.

36.4 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.

Previously reclaimed lands that require re-disturbance to facilitate the revision of a final surface configuration will be handled in the method described below. Prior to re-disturbance all topdressing that can practicably be recovered by standard mining equipment and practices will be removed prior to any reclamation work. Topdressing recovered from these areas will either be placed in an approved stockpile for storage, or it will be directly hauled from the removal site to another site for final placement.

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 36-1](#) 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 36-1](#) 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.

36.5 Topdressing Balance

Section 14 – Soil 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 1, 2, 3, and 4 North ([Table 36-1](#)). 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 36-1](#) 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 1, 2, 3, and 4 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, Section 14 – Soil.

Salvageable topdressing is the estimated amount of material that can actually be supplied to the reclaimed areas. It is predicted to be 10 percent less than what is available. This 10 percent reduction is primarily a result of handling the material several times and loss during storage.

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 2, 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 2 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 37 – Post-Reclamation Vegetation.

Current topdressing replacement depths are as follows:

Area 1	=	8.7"
Area 2	=	5.6"
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In order to achieve these depths the following actions will occur in each mine area.

36.5.1 Area 1

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 36-1](#) 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.

36.5.2 Area 2

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 36-1](#) provides estimated volumes of in situ topdressing resources that may be salvaged from each discrete borrow area within Area 2.

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.

36.5.3 Area 3

[Table 36-1](#) provides estimated regolith volumes in the Dixon area to be used as topdressing material.

36.5.4 Area 4 North

All in situ material will be used in revegetation of the area. [Table 36-1](#) details the available resources and the number of acres to be reclaimed.

36.6 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 36-1](#)) 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 36-2](#).

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 20 – Operations Plan 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 14.H

36.6.1 Root-Zone Analysis

The samples are sent to a soil analytical laboratory for analysis. Methods of analysis and analytical parameters are listed in [Table 36-2](#).

36.6.2 Root-Zone Suitability

Root-Zone suitability will be determined by using the OSMRE ROOT-ZONE SUITABILITY CRITERIA FOR NAVAJO MINE, (Table 36-2). 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 this section

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 without 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.

36.6.3 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

36.6.4 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 30. 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.

36.6.5 Mitigation Resources

[Table 36-3](#) 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.

36.6.6 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 36-3](#) is based on a mitigation rate of 5% for Areas 1 and 2 with total-rootzone volume of (323 yds³/ac) and 10.8 percent for Areas 3 and 4 of the total root-zone volume (697 yds³/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.

36.6.6.1 Area 1

Area 1 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 Exhibit 14-1 and on Table 22-10.

36.6.6.2 Area 2

Mitigation material in Area 2 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 Exhibit 14-1 and volumes in Table 22-10 and [Table 36-3](#).

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.

36.6.6.3 Area 3

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 Exhibit 14-1 and volumes identified in [Table 36-3](#).

36.6.6.4 Area 4 North

Area 4 North has sufficient material needed for mitigation resources. To ensure adequate mitigation resources for Area 4 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 36-2](#). This drilling and sampling was conducted in 1987 with locations of the drill sites detailed in Table 17-1 and Figure 17-4. Appendix 17.B, 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 4 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 36-3](#), 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.

Navajo Mine Permit Application Package

Table 36-1 Topdressing Resources at Navajo Mine December 2003

Topdressing/Topdressing substitute Supply	Mine Area			
	1/4	2/4	3/5	4 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 2 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

Table 36-2 OSMRE Root Zone Suitability Criteria for Navajo Mine¹

Characteristic	Suitability Limits	Analysis Method
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
pH	>5 and <9	Page et al., 1983
EC	<16 mmhos/cm	Page et al., 1983
Acid-base account	> -5 t CaCO ₃ /1000 t	Sobek, A. A., et al., 1978, EPA 600/2-78-054
Texture	<50% Clay	OSMRE Letter 8/26/86, paragraph 3.6.
Saturation	<85% OR <100% only if EC>4 mmhos/cm	Richards, 1954 Agricultural Handbook No. 60
Selenium total	<2.5 ppm	Bajo, 19782
Selenium soluble	<0.26 ppm	Page, et al., 1983

¹Criteria to be applied to each separate sample increment.

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

Table 36-3 Mitigation Resources at Navajo Mine – December 2003

Mitigation Material Supply	Mine Area			
	1	2	3	4 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 4 North 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

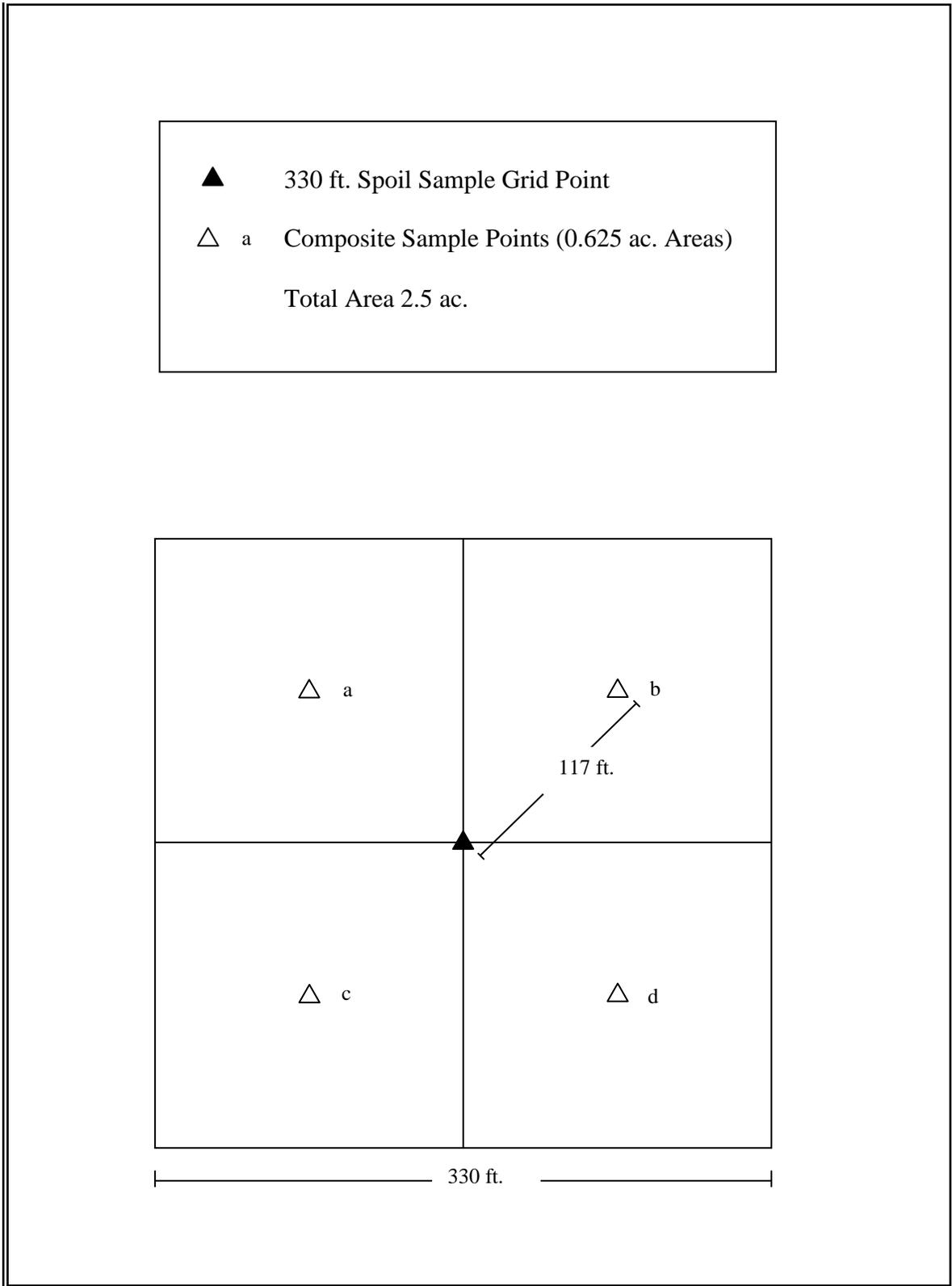
¹ These areas are loose consolidated sandstone overburden which will be removed during pre-strip operations

² These are previously mined spoils suitable 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 4 North including drillsites 487-01, 487-02, 487-03, & 487-05.

⁵ Volumes reflect a 10.8% mitigation rate per acre. Mitigation rate is explained in Section 36.6.5 Mitigation Resources

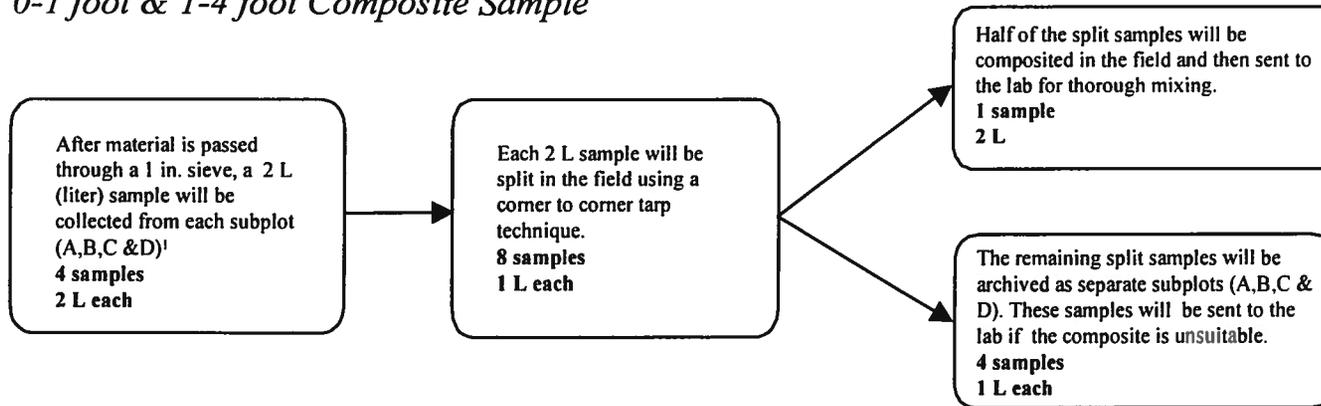


Spoil Sampling Layout

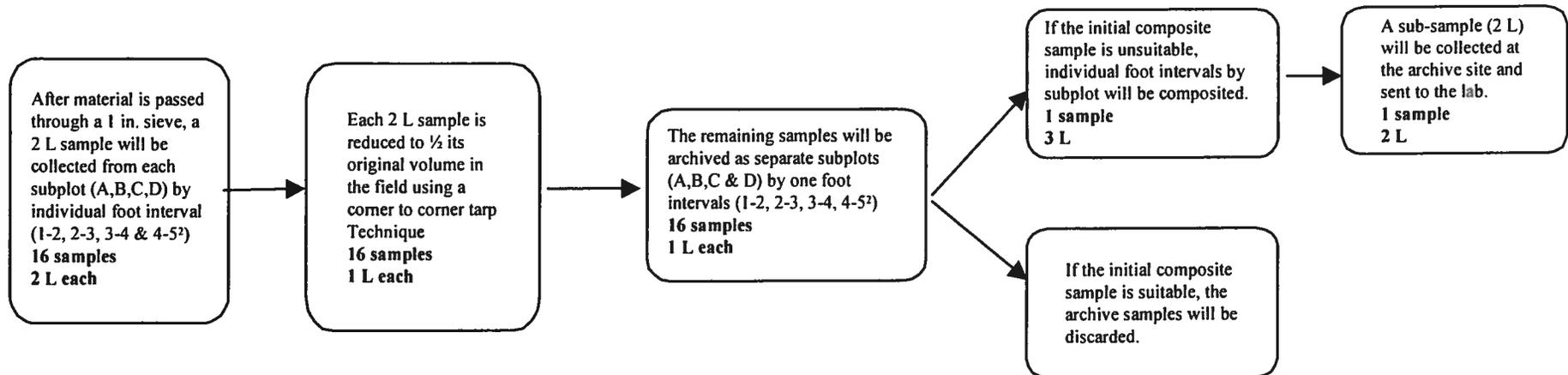
Figure 36-1

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.

Figure 36-2

Topsoil and Mitigation Schedule by Year and Pit

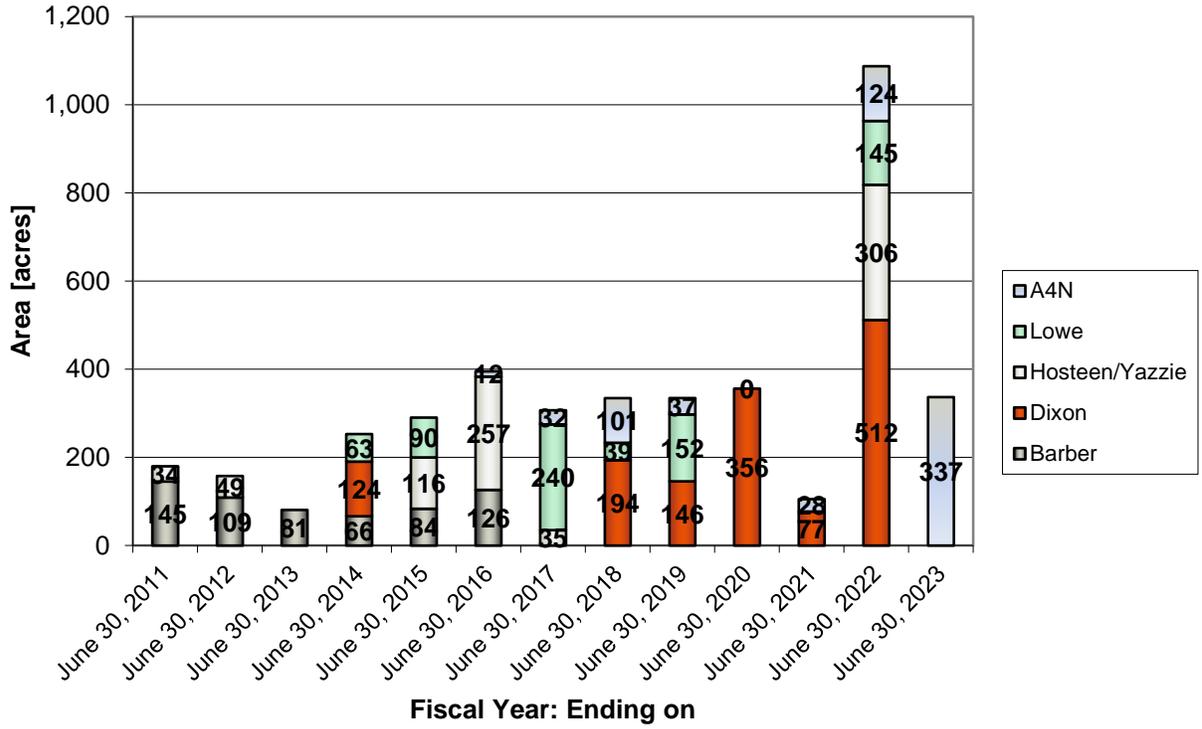


Figure 36-3