CHAPTER 14

LAND USE

CHAPTER 14

INDEX

LIST OF FIGURES

LIST OF TABLES

ATTACHMENTS

CHAPTER 14

LAND USE

Existing and Historical Land Use

Livestock grazing, habitation, wildlife habitat, and coal mining are the predominant current land uses both in terms of the livelihood of the people living on the Black Mesa leasehold and impacts on the land. Land uses of lesser significance include agriculture, gathering of plant materials, commercial trapping and various forms of outdoor recreation. There are no commercial developments on or near the leasehold except for Peabody's coal production, transportation and support facilities, and the Black Mesa Pipeline Company's coal slurry preparation facility. The uses of the land preceding mining activities are the same as the current non-industrial uses. A land use map (Drawing 85100) may be found in Chapter 25.

Livestock grazing is the primary premining land use on the leasehold. Grazing is carried out year-long. All classes of livestock are grazed, although sheep and goats are most prevalent. Animal husbandry practices cannot be considered production oriented in the sense of the traditional ranching industry in the western United States. Livestock are used in the lease area for food, exchange, trade, as a ceremonial substitute for game animals, a teaching tool of "the way of life" for children and as a means of providing social wealth and respect. Livestock provide a source of income primarily on the basis of seasonal cycles of credit obtained at local trading posts from wool and lamb sales (Wood et al. 1979).

Livestock are grazed on lands considered as "belonging to" a particular family or extended family camp. Grazing permits, prescribing the number of animal units which can be grazed, are issued by the Bureau of Indian Affairs for these customary use areas. The system is somewhat analogous to the grazing allotment and permit system used on public lands. Grazing permits in the Joint Use Area were cancelled in 1972. Enforcement of the permit requirements is difficult. An estimated 110,000 sheep units are currently not covered by permits reservation wide (BIA 1983). The grazing or customary use areas that have been identified on the leasehold by the Navajo Tribe are shown on Drawing 85100. Customary use area boundaries have not been asssigned in the southeast portion of the leasehold.

Individual family dwellings or extended family camps with several dwellings occur on the leasehold. These dwellings are often associated with the customary use areas. The locations of these dwellings are shown on Drawing 85100. No concentrated population centers are present.

Wildlife habitat and the associated commercial and recreational activities are land uses on the leasehold. Wildlife habitat is viewed as a predominant land use on and surrounding the leasehold by the Tribes and the Bureau of Indian Affairs. Small game hunting, commercial trapping, bird watching, photography and hiking may occur to a limited extent north of the leasehold near the rim of Black Mesa. The area of Black Mesa near the leasehold is closed to all big game hunting.

An agricultural plot survey of the Black Mesa leasehold identified 31 small fields where the land was in use for, or had been used for the production of adapted crops. Corn was the primary crop grown. The total area of all plots equaled 138 acres with individual plots averaging approximately 4.5 acres. These plots are typically located on terraces adjacent to major drainages and did not exhibit evidence of continued, annual use. No yield data are available, but yields should be quite variable since the farming technique relies totally upon rainfall timing and amount. The locations of the farm plots are shown on Drawing 85100.

The gathering of plant species for cultural, medicinal, edible, construction and heating purposes also occurs on the leasehold. A list of plants and their uses is presented in Chapter 9 (Attachment 3). A large proportion of families haul wood for heating and construction purposes.

The only previous mining in the permit area of which Peabody is aware took place at the Kayenta #1 and Kayenta #2 (Maloney) mines (Kiersch 1956). The mines were small underground room and pillar operations located in the vicinity of Coal Mine Wash in what is now the mined out N-1 and N-7/8 coal resource areas. The Kayenta #1 mine was operated for an undetermined length of time, but closed in 1950. It produced 300 tons of coal for the year ending June 30, 1950. The Kayenta #2 mine operated from 1946 to 1952. Production was 502 tons during the year ending June 30, 1950, and 140 tons the following year. The coal seam that was mined corresponds to the blue seam (Peabody designation). Both of these previous mining operations were mined through by Peabody in the process of surface coal mining in N-1 and N-7/8.

Land Capability and Productivity

Soil Conservation Service land capability groupings indicate, based primarily on edaphic and climatic conditions, the suitability of lands for a wide range of land uses. The soils which occur on the Black Mesa leasehold are placed in capability Classes VI and VII (Chapter 8). Soils in these classes have severe (Class VI) to very severe (Class VII) limitations that make them unsuitable for cultivation and limit or restrict their use largely to pasture, range, woodland or wildlife habitat. Soils in these groupings are used primarily for livestock grazing. The lands on the leasehold have received a Negative Determination as Prime Farmland from the Soil Conservation Service (Chapter 8).

The dominant vegetation communities on the leasehold are pinyon-juniper woodland (65-70 percent) and sagebrush shrubland (30-35 percent). These plant communities are described in detail in Chapter 9. The productive potential of these communities in terms of rangeland, has been rated from very low on some soils to high on others.

Stoddard and Smith (1955) describe the grazing utility of the pinyon-juniper woodland grazing region as "ideally suited for spring range, especially lambing range". Shallow, rocky soils and low rainfall contribute to the lack of potential productivity of the woodland; and since the region is not amenable to cultivation, it is often made to support an overabundance of livestock as more productive range is lost to cultivation. The result has been an estimated 60 percent depletion in the productivity of this range region in the western United States (Stoddard and Smith 1955).

Stoddard and Smith (1955) describe the intermountain shrub region (big sagebrush type) as "essentially a spring and fall range". A large part of the region appears to have once been dominated by cool season bunchgrasses, with sagebrush occurring only as a subdominant. Heavy overgrazing on the type has been almost universal (Stoddard and Smith 1955) resulting in substantial loss in productivity as big sagebrush dominates.

Chapter 9 discusses the condition of the ranges on the Black Mesa leasehold. Moderate to severe erosion, indications of downward range trend and low carrying capacity figures are indicative of the poor condition of these ranges.

The 1964 soil and range inventory of the 1882 Executive Order Area conducted by the Bureau of Indian Affairs includes a significant portion of the leasehold. The survey

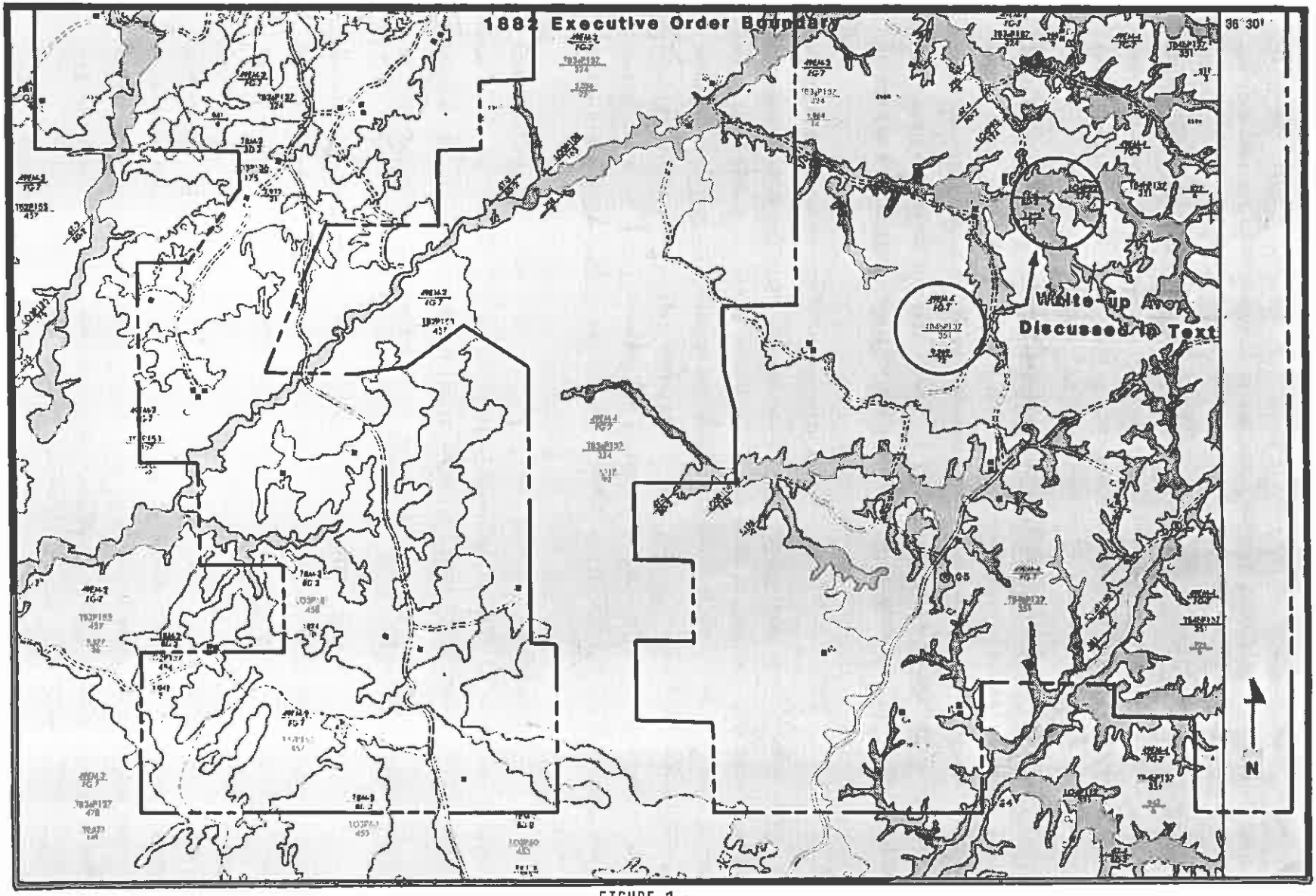
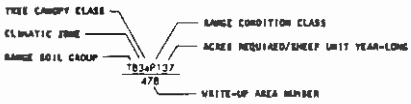


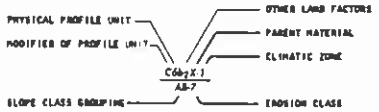
FIGURE 1
Soil and Range Map (extracted from Sheet Number Arizona 55; BIA, 1964)

LEGEND

RANGE SYMBOL



SOIL SYMBOL



RANGE SOIL GROUPS

OV	OVERFLOW	SW	SHALLOW
SL	SALINE LOWLAND	SSW	STEEP SHALLOW
SU	SALINE UPLAND	SVS	STEEP VERY SHALLOW
SA	SANDS	TB	THIN BREAKS
SY	SANDY	RB	ROUGH BROKEN
LO	LOAMY	NU	NON-USABLE
CY	CLAYEY		

PHYSICAL PROFILE UNITS

	DEEP SOILS 36" PLUS PERMEABILITY					MODERATELY DEEP SOILS 20"-36" PERMEABILITY					SHALLOW SOILS 10"-20" PERMEABILITY					VERY SHALLOW SOILS 5"-10"
TEXTURE	VSP	SP	MP	RP	VRP	VSP	SP	MP	RP	VRP	VSP	SP	MP	RP	VRP	
FINE	1	2	3			13	14	15			25	26	27			16
MEDIUM	4	5	6	7	8	16	17	18	19	20	28	29	30	31	32	17
COARSE	9	10	11	12		21	22	23	24		33	34	35	36		18

39	DEEP, ORGANIC SOILS	45	SOILS LESS THAN 5" THICK
40	MODERATELY DEEP, ORGANIC SOILS	46	[illegible]
41	SHALLOW, ORGANIC SOILS	47	BARREN LANDS
42	VERY SHALLOW, ORGANIC SOILS	48	ACTIVE SAND DUNES
43	ROUGH, BROKEN OR STONY LAND	49	THIN BREAKS
44	GULLIED LANDS	50	RIVERWASH

CLIMATIC ZONES

	APPROX. PPT.	APPROX. ELEVATIONS	CLIMAX VEGETATIVE FORMATIONS
1	9 - 9"	UNDER - 5,500'	SEMI-DESERT GRASSLAND
2	8 - 12"	5,500' - 6,200'	MIXED GRASSLAND
3	13 - 15"	6,200' - 7,000'	SAGEBRUSH GRASSLAND
4	15 - 17"	6,500' - 7,500'	PIÑON-JUNIPER WOODLAND

MODIFIER OF PROFILE UNITS

C	COARSER SIDE OF MEDIUM TEXTURES (MODERATELY COARSE TEXTURES)

PERMEABILITIES

VSP	VERY SLOWLY PERMEABLE
SP	SLOWLY PERMEABLE
MP	MODERATELY PERMEABLE
RP	RAPIDLY PERMEABLE
VRP	VERY RAPIDLY PERMEABLE

OTHER LAND FACTORS

b_2	FREQUENT OVERFLOW
r	ROCK OUTCROP (5% OR MORE OF AREA)
ss	SALINE-SODIC SURFACE SOIL (0-10")

PIÑON-JUNIPER CANOPY DENSITY CLASSES

a	11 - 39%
b	40 - 69%

RANGE CONDITION CLASSES

E	EXCELLENT	F	FAIR
G	GOOD	P	POOR

PARENT MATERIAL

B	BASIC IGNEOUS ROCK
D	LOESS
E	SHALE
M	SANDSTONE
P	GRAVEL & SAND
Q	AEOLIAN SANDS
T	FOOTSLOPE ALLUVIUM
X	FLOODPLAIN ALLUVIUM

SLOPE CLASSES

A	0 - 1%	E	8 - 12%
B	1 - 3%	F	12 - 25%
C	3 - 5%	G	25 - 55%
D	5 - 8%	H	55% +

SOIL & RANGE BOUNDARIES

- SOIL & RANGE SITE BOUNDARY
- RANGE CONDITION BOUNDARY
- TREE CANOPY DENSITY CLASS BOUNDARY

ACREAGE & STOCKING RATE SYMBOL

EROSION CLASSES

1	SLIGHT	5	SEVERELY GULLIED
2	MODERATE	6	SLIPS & LANDSLIDES
3	SEVERE	7	UNDIFFERENTIATED
4	GULLIED		

WORKS & STRUCTURES

- PAVED ROAD
- GRADED ROAD
- UNIMPROVED MOTOR TRAIL
- IMPORTANT HORSE & FOOT TRAIL
- BRIDGE
- FENCE
- GATE
- CATTLE GUARD
- DOWN FENCE
- POWER TRANSMISSION LINE
- TELEPHONE LINE
- HOUSE OR HOGAN
- SCHOOLHOUSE
- CHURCH
- RADIO TRANSMITTER
- MINE
- CORRAL
- CEMETERY
- GP — GRAVEL PIT
- DIPPING VAT

WATER & DRAINAGE

- DAM
- RETENTION DAM & POND
- BROKEN DAM
- LAKE OR POND
- INTERMITTENT LAKE OR POND
- WATERSPREADER
- CHARCO AND COLLECTOR DIKE
- SPRING, UNDEVELOPED
- SPRING DEVELOPMENT
- WELL
- WINDMILL
- WINDMILL & TANK
- B203 — WELL NUMBER
- CANAL OR DITCH
- UNCLASSIFIED DRAINAGE
- WATER PIPELINE

CULTIVATED AREAS

- L — UNDELINEATED (SMALL)
- DELINEATED
- FENCED

BOUNDARIES, MARKS, MONUMENTS

- COUNTY LINE
- RESERVATION BOUNDARY
- CITY, VILLAGE OR BOROUGH
- BOUNDARY MONUMENT
- SECTION CORNER (FOUND, MONUMENTED)
- QUARTER CORNER (FOUND, MONUMENTED)

SPECIAL SYMBOLS

- ROCK ESCARPMENT
- PROMINENT HILL OR MOUNTAIN PEAK
- HILL OR MOUND
- BLOWOUT
- ROCK OUTCROP
- STONINESS
- GRAVEL
- ALKALI SPOT
- G2 — SOIL SAMPLE LOCATION
- LAND HOOK

FIGURE 1
(Continued)

characterized the pinyon-juniper range sites as having low productive potential and the sagebrush-grassland range sites as having medium to high potential (BIA 1964). The survey found 1,420,401 acres of the area to be in poor condition, 328,535 acres in fair condition and none in good or excellent condition (BIA 1964). A 9,969-acre map unit in which a portion of the leasehold occurs was determined to be capable of supporting only 72 sheep units year-long (Figure 1; write-up area 351). Similarly, a 1,388-acre map unit along Reed Valley Wash and tributaries was determined to have high potential, but to be in poor condition (Figure 1; write-up area 174). The unit required 99 acres to support one sheep unit for one year.

The majority of soils found on the leasehold have moderate to severe limitations for sanitary facilities, building site development, construction material and water management (refer to soil interpretation records in Chapter 8). Limitations are caused primarily by slope, depth to bedrock, soil strength, soil texture and percolation rates.

The abundance of wildlife is related to the extent, diversity, quality and condition of habitat. Wildlife studies conducted on the Black Mesa have shown a scarcity of wildlife species and numbers (Chapter 10). This observation reflects primarily on the condition, diversity and quality of the supporting habitats. Most are relatively simple communities in terms of structure and diversity (grasslands and shrublands), and all are in poor condition. The woodlands offer the most complexity and could, therefore, potentially support greater wildlife numbers if managed properly.

The discussion of important plant species (Chapter 9, Page 65) indicated that the pinyon-juniper woodland is placed in the noncommercial category of the U.S. Forest Service classification system for forested lands. This generally places the woodland in a "no value" category (Johnson, 1975) probably because the tree species composing the type are not noted for the capability to provide dimension lumber due to their poor growth habit. However, LeBaron (1968) suggested that commercial exploitation of the trees is feasible in some circumstances. It is now recognized that the pinyon-juniper woodland has the capability to provide an array of forestry products such as firewood, fence posts, specialty wood products, Christmas trees and pinyon nuts. On the Black Mesa, the woodland is utilized primarily on a noncommercial basis for firewood, corrals, and pinyon nuts. Some revenue is generated from the sale of Christmas trees.

The condition and productivity of pinyon-juniper woodlands, and especially localized stands such as the woodland on the Black Mesa leasehold, in relation to forestry products is difficult to assess. The Forward to the Proceedings of the Pinyon-Juniper Conference

(Everett, 1987) eludes to the lack of knowledge concerning this vegetation type in the following quote. "The vegetation type is poorly understood, inadequately defined, and often misused. Significant management problems are identifying and classifying woodland sites, understanding woodland ecology, and proper management for sustained productivity." It is also difficult to apply the results of the baseline vegetation studies (Chapter 9), which were designed primarily from an ecological standpoint, to the few methods available for commercial inventory and classification. Further, much of the information in the literature relating to productivity does not specify stand characteristics where the data was collected. This makes it difficult to relate the data to the Black Mesa stands. However, enough information is available to at least indirectly assess the productivity of the pinyon-juniper on and around the leasehold.

Fuelwood appears to be the product that has the most potential for commercial exploitation in pinyon-juniper woodlands. Peabody's consulting soil scientist for the latest baseline soil surveys requested information from the Soil Conservation Service pertaining to fuelwood production on the residual soils found on the leasehold. For those soils which are considered true pinyon-juniper sites (the residual soils), the Soil Conservation Service provided fuelwood figures expressed as cords of wood per acre (Attachment 1). The figures ranged from 10 to 15 cords per acre. The letter contained in Attachment 1 stated that these figures are annual yield estimates. However, after discussion they indicated that the 10 to 15 cords were actually standing crop estimates and that annual production ranged from 25 to 35 cubic feet (1 cord = 128 cubic feet). The standing crop figures are similar to values reported in the literature. For example, Ronco (1987) reported cord wood volumes ranged from 0.8 to 25 cords per acre in stands measured in northern New Mexico and Arizona, depending on age, species composition, and density. He also reported ranges of production from as low as one fence post per acre per year to as much as 45.6 cubic feet per acre per year.

The baseline vegetation studies indicate that the true woodland sites on the leasehold consist of rather mature and often decadent stands of trees (Chapter 9, Page 22). The stands are fairly dense, have a high proportion of junipers and have high average basal areas. It appears then, given the variability within and between the woodland sites on the leasehold, that they are capable of yielding from 10 to 15 cords of wood per acre, but this is not on a sustained yield basis. On the deeper alluvial and eolian soils, where the trees are considered invaders, fuel wood yields would be much lower.

The Navajo Division of Forestry has indicated that no fuelwood cutting permits were issued

in 1986 for the Black Mesa area. This strongly suggests that no commercial exploitation of the fuelwood resource is occurring, probably because the Black Mesa is situated so far from large population centers where the demand is greater. Permits are not required for collecting dead and down wood. Use is probably confined to local residents or other Native Americans situated close enough to the resource to make hauling feasible.

Peabody has been unable to find any references pertaining to the productivity of pinyon-juniper woodlands for fence posts. As noted, residents on the Black Mesa have been observed to use dead and down wood to construct corrals. The stature of the trees on the true woodland sites on the leasehold probably restricts their potential for producing fence posts.

Peabody is aware of feasibility studies conducted in pinyon-juniper stands to assess the potential for specialty wood products (resins, oriented-structure board, paper, etc.). Researchers on the Navajo and Hopi Reservations concluded that resins and other products such as firewood, charcoal, lumber, paper, and pressed wood could not be harvested at a low enough cost and in sufficient quantities to be commercially competitive under the economic conditions prevalent at the time (Deaver and Haskell, 1955). More recently, researchers in Nevada concluded that the current costs of chipping and hauling proved too great for feasible production of pressed board. However, a cement board plant appeared feasible at a site in eastern Nevada (Murphey, 1987).

Peabody has not been able to find information documenting the potential yield of chips from woodland stands or the optimum stand characteristics needed for economical production. Undoubtedly, the pinyon-juniper sites on Black Mesa would have good potential based upon the large volume of material available. However, under current economic conditions, commercial harvesting in any stand does not appear economically feasible (Henderson and Baughman, 1987).

The popularity of pinyon Christmas trees has grown in recent years as indicated by its marketability in states which have pinyon-juniper woodlands (Clary, 1975). Management of pinyons to produce Christmas trees is advocated for sites having deep soils where the growth form of the trees is suitable for commercial or private use.

Peabody has not been able to find any information documenting the yield of Christmas trees in stands of pinyon-juniper woodland, or the composition and structure of stands necessary

to produce a viable resource. Undoubtedly, the age and composition of the pinyon-juniper woodland sites on the leasehold are such that harvestable trees are few. Most stands support a high proportion of junipers relative to pinyons. On deeper sites where pinyons have invaded the shrublands, they are small enough to make harvesting feasible.

The Navajo Division of Forestry issued 113 Christmas tree tags for the Black Mesa area in 1986. The tags generated $169.50 in income. The majority of the tags were probably bought by Peabody employees living in Kayenta, Arizona.

The pinyon-juniper type also produces edible food in the form of pinyon nuts. The total pinyon nut crop averages from one to two million pounds annually (Little, 1941). The better natural stands may yield 300 pounds of nuts per acre during a good year (Springfield, 1976). Yields are cyclic, occurring every four to seven years.

The pinyon nut yield figures presented were not supported by stand composition or age information. Presumably, they came from woodland sites where pinyons were either dominant or formed pure stands. Pinyons are proportionally more abundant than junipers as elevations exceed 7,000 feet (Springfield, 1976). The majority of stands evaluated on the Black Mesa leasehold were below 7,000 feet in elevation. Consequently, junipers are dominant (Chapter 9, Page 22). This would indicate that the stands are of minor importance with regard to pinyon nut production because of a low potential for significant yields. Yields could be expected to be well below the 300 pounds per acre per 4 to 7 years reported in the literature.

Postmining Land Use

The most significant premining land use of the areas to be affected by mining and related activities proposed under this permit application appears to be livestock grazing. All of the other premining land uses which were previously discussed are of a lesser importance than livestock grazing from a cultural and economic standpoint. However, the Tribes and the Bureau of Indian Affairs have indicated that wildlife habitat and other less significant land uses are important, and that reclamation efforts should restore a landscape that is suitable for these potential uses. Therefore, Peabody has designed its reclamation efforts to return mined lands to the land use of livestock grazing and wildlife habitat. The reclamation procedures are also designed to consider other uses such as restoration of culturally significant plants in the postmining landscape.

All lands located outside of metropolitan areas are considered wildlife habitat. Except under special conditions such as unique or critical habitat, notably habitat critical to the needs of threatened or endangered species, wildlife habitat is not considered a specifically defined land use category. Much of the land in the western United States which is not capable of supporting agriculture is designated as rangeland, and secondarily wildlife habitat. The wildlife studies conducted on the Black Mesa leasehold have shown a scarcity of wildlife species and numbers. This is due in part to the relative quality of the natural habitats, and in part to land use decisions which have been made by the inhabitants and users of Black Mesa. The land use decisions are based upon social welfare and economics. Livestock grazing, at the expense of wildlife habitat quality, is the most significant land use in terms of the livelihood of the people who live on the Black Mesa. For this reason, Peabody's reclamation activities are designed to achieve suitable mitigation of the impacts to wildlife and wildlife habitat identified in the Wildlife Resources Chapter (Chapter 10) while fulfilling the objective of returning mined lands to productive grazing land. Wildlife habitat, although different than that found in the premining condition, is a direct benefit of achieving a productive and stable postmining landscape.

Plants gathered for cultural, medicinal or edible purposes are generally available throughout northeastern Arizona; therefore, the proposed mining disturbances do not present a significant reduction in access to or threat to continued existence of these plants. Several of the species identified in Attachment 3 of Chapter 9 are contained in Peabody's revegetation seed mixes or plantings (for example, globemallow, galleta, blue grama, Indian ricegrass, fourwing saltbush, Colorado pinyon pine, Utah juniper, cliffrose, and skunkbush).

There is no indication that the amount of wood that will be lost as a result of mining will affect demand for this resource. During site clearing activities, the tree materials are placed in piles when feasible to do so. These piles are available to the residents to use for whatever purpose they choose, or are left as wildlife habitat. Also, Peabody maintains a public coal loadout facility to supply home heating coal to local residents. Residents are not charged for this coal. The availability of these sources of fuel and construction material offset the demand placed on the resource. Since the remaining resource is naturally renewable, demand has decreased, and the Revegetation Plan contains provisions to restore pinyon and juniper in the postmining landscape, the effects of mining on this land use will be partially offset. Pinyon and juniper restoration will

provide seed sources in the reclamation which will increase the reinvasion potential of these species into the reclaimed landscape.

The total acreage of farm plots (approximately 138 acres) represents 0.213 percent of the total lease area. These plots are typically located on the terraces adjacent to major drainages which are not normally disturbed by mining activities. A comparison of the Land Use Map on which the plots are located (Drawing 85100) and the Affected Lands Map (Drawing 85360) indicates that seven such plots are projected to be disturbed during the remaining life-of-mine. These plots include: 1) three 280-foot by 280-foot fields located in the south end of the J-21 coal resource area near the Kee Williams residence; 2) one 200-foot by 200-foot field in the no coal area in the center of J-21 near the Thomas Lake residence; 3) two fields on opposite sides of Reed Valley Wash at the north end of J-19 which are 320-foot by 320-foot and 200-foot by 200-foot in size; and 4) one 200-foot by 200-foot field near the James Cody residence at the northeast side of the N-6 coal resource area. The total acreage of the seven plots that are projected to be disturbed is approximately 15.8 acres, representing 0.12 percent of the total projected 1986-2011 disturbance acreage.

As previously noted, the farm plots are typically located on terraces adjacent to drainages where soil depths are greater and slopes are at a minimum. The flatter slopes on the terraces allow for greater infiltration and less runoff during the erratic rainfall events experienced on the Black Mesa. Since extremely variable rainfall patterns are relied upon to meet the moisture requirements of the plants, poor yields or total crop failures are common. A sociocultural assessment of the livestock reduction program in the Navajo/Hopi Joint Use Area prepared for the Bureau of Indian Affairs, Flagstaff Administrative Office, by staff of the Northern Arizona University (February 1979), provides insight as to the importance of rainfall on farming in the area. The following statement was made on Page 73: "The number of households who farm also fluctuates periodically with good and bad years of rainfall. One respondent, for example, said that members of the household did not farm in 1977 because there was not enough rain". It appears then, that these fields are established strictly on an opportunistic basis. No evidence of historical or current flood irrigated cultivation, including dikes and diversions, has been discovered within the leasehold (Volume 11, Chapter 17, Page 22). Flood irrigation or subirrigation for cultivation is also precluded by the surface water occurrence and quality, ground water quality and availability, and the geomorphology of the drainages (Volume 11, Chapter 17, Page 18).

Further evidence of the poor adaptability of the farm plots for crops is evidenced by the planting arrangements used to reduce interspecific competition for moisture. Plants are typically placed several paces apart in a row, with rows spaced several paces apart. The low plant density contributes to low yields.

Because of the low potential for production, any crop produced is used in the household as a diet supplement. Crop yields are not used to provide income from sales outside the household. Kelley, in Navajo Land Use - An Ethnobotanical Study (1986) makes reference to farm plots throughout her discussion as "kitchen gardens".

In most situations, the farm plots (or kitchen gardens) are located near the homesites of one or more individuals. As areas are affected by surface mining activities, these individuals are relocated. The possibility that any of these individuals would move back on the reclaimed areas is remote. Such a move would have to be made at an individual's own expense. Thus, there is no way of predicting how many individuals, if any, might return to their original homesites. Any attempt to reestablish farm plots on the reclamation would be logistically unreasonable. Farm plot locations would be dependent on the possibility of an individual reestablishing a homesite, the homesite location in relation to topographic and soil features influencing the best choice for a field, and an individual's needs or desires.

It is Peabody's belief that the farm plots identified are not cropland as defined in the regulations at 30 CFR Part 701.5. Therefore, an application for approval of an alternative land use to enable implementation of the reclamation plan is not warranted. In reviewing the Preamble to the Permanent Regulatory Program regulations (44 FR 14931, March 13, 1979), and in particular the discussion of "cropland" and "historically used for cropland", it is apparent that the intent of the Act and the implementing regulations is to protect and/or return areas to cropland that have had a sustained and viable use over time. For purposes of the Act, "intensive agricultural purposes" is defined to mean cropland with intensity further relating to inputs of large amounts of working capital and labor. The previous discussion indicates that the farm plots are not production oriented in the sense of income generation. They are strictly opportunistic garden plots used to augment the household food supply. Large amounts of capital and labor are not expended for production purposes.

Should OSMRE disagree with Peabody's position that a change in land use is not needed,

then Peabody requests approval for a land use change from the "kitchen gardens" discussed above to grazing land and wildlife habitat. The proposed reclamation plan (Chapters 21 through 24), plus the information presented below clearly provide sufficient documentation for approving a change in land use pursuant to 30 CFR 816.133.

The soils on the Black Mesa leasehold are placed in capability Classes VI and VII. They have a number of extreme and/or severe limitations that restrict their use to grazing, woodland, or wildlife. Any attempts at cultivation are tenuous at best. Soil conservation practices must be applied to maintain the soil resource and its productive capability. Because of the capability classes of the soils and the lack of conservation practices, the use of these areas for cropland cannot be viewed as proper management. Cropland is not the highest and best use. As noted in the Preamble to the regulations, "the Act's legislative history makes clear that Congress did not intend for the postmining use of the land which had been improperly managed to be limited to its most recent premining use. Congress intended for the postmining use of land to be based on its potential utility for a number of uses before mining, not some low use which may have resulted from mismanagement". Therefore, reclaiming all areas to rangeland and wildlife habitat are higher or better uses. These uses are achievable since they are the predominant use on undisturbed areas and will not present any hazards to public health or safety, or threat to water diminution or pollution. They are the most practical, productive, and reasonable uses for the area, are consistent with land use policies, will result in more contemporaneous implementation, and will not violate any Federal, State, or local laws. For these reasons, cropland cannot realistically be considered as a postmining land use option.

No material effects are incurred on the premining land use of habitation. Occupied dwellings and associated structures located within mining areas are relocated at the expense of Peabody. Peabody either buys the existing structures at their appraised value or replaces the structures in kind at an agreed upon location. Most of the relocations required for the proposed mining activities have already been accomplished.

Land use support measures undertaken by Peabody include maintenance of facilities not used in mining operations such as light duty vehicle roads used for public activities (e.g., school bus routes), maintenance of homesite access routes, reconstruction of livestock ponds which naturally deteriorate with time, creation of tree and brush piles in conjunction with land-clearing activities, installation of drinking and livestock water

acquisition sites, construction of a public coal distribution facility, development of homesites and reimbursement of families relocated due to mining activities. Land disturbances are held to a minimum. Only those areas which have been reclaimed, long-term topsoil stockpiles, areas which might pose safety hazards to humans or livestock, facilities and areas requiring security measures such as warehouses are fenced. This allows livestock and wildlife to safely access those portions of the leasehold which are not directly involved with the active operations.

This discussion indicates that the proposed postmining land uses represent no change from the premining land uses. The remaining land uses are largely inconsequential, will not be significantly affected by mining activities, or are considered in relation to their relative importance in the Reclamation Plan.

Land Use Plans and Policies

Comprehensive land use planning or policy development has not been conducted by land management agencies or the Navajo Tribe for the region in which Peabody's operations are conducted. Peabody cannot presume to have responsibility for such planning activities and, therefore, has designed a reclamation program to achieve postmining land uses which are essentially the same as premining land uses.

Peabody is a temporary land steward, obligated to reclaim lands disturbed by mining so that such lands may be returned to the appropriate land management agency in a condition compatible with and capable of supporting the postmining land uses. Peabody's reclamation procedures address how the postmining land uses will be achieved by describing those activities which will be conducted by Peabody following the extraction of coal and continuing until the land is returned to the appropriate land management agency.

Peabody's reclamation procedures represent an intensive land management program. Each element of the program is designed to support the achievement of the postmining land use of livestock grazing and wildlife habitat. The postmining land uses have been documented to be the same as the premining land use. This permit application package also contains vegetation and soils monitoring programs which demonstrate that reclaimed lands are suitable for the postmining land uses.

Peabody has established communications with the Navajo Coal Commission and the Western

Navajo Agency, Bureau of Indian Affairs regarding land use planning and reclamation. Several meetings have been held to discuss the current status of regional planning activities and steps that could be taken by the Tribe and BIA to implement planning activities for the northern Black Mesa area. Further, the Tribe is developing and intends to implement a special grazing management plan for the reclaimed areas. Peabody has informed both organizations that it is willing to cooperate to the greatest extent practicable with any efforts that may be undertaken to develop a regional land use plan. It is Peabody's understanding that efforts have been made to initiate a cooperative planning process involving the BIA and the Tribe. These efforts have included identification of short and long-term goals and several meetings with local residents to solicit input for the planning process. The BIA and Tribal representatives have informed Peabody that they will involve Peabody in this planning process when they feel such involvement is appropriate.

Grazing Management Plan

The following plan details a general framework for development and implementation of grazing and proper management of reclaimed lands within the Black Mesa leasehold. The plan will require coordination and initial assistance from Peabody Coal Company, but successful implementation and development of detailed management plans at the operator level will be dependent on the Bureau of Indian Affairs (BIA), the pertinent Tribal agencies, and the individual operators or family units to be using reestablished customary use areas and yet to be developed grazing units or customary use allotments. Peabody assumes no responsibility for the implementation or the success or failure of this plan. However, based upon current range research and practice, it is Peabody's belief that this plan incorporates the most appropriate grazing methods for the lands involved.

According to the draft Land Use Plan for Black Mesa Mining Area (Revision 3/87) developed by the Navajo Tribe and the BIA and provided as Attachment 2, all individual customary use areas in place prior to mining will be honored after reclaimed lands are returned to the Navajo Tribe. In addition, all enabling facilities such as water developments, sediment ponds, power transmission lines, fences and portions of the road system will be inventoried and evaluated for permanent retention. Included in the inventory will be any special use areas or unique wildlife habitat such as reclaimed Mexican vole habitat, internal impoundments, and special wildlife habitat plantings. Discussions with Leo Beno, Reclamation Specialist with the Navajo Tribe, indicate that at least 21 customary use areas have been identified for reestablishment above the Executive Order Line, but that all areas under Navajo jurisdiction below that line will have a number of customary use

allotments developed with a certain number of family units assigned to each (personal communication, October 1987). The same kinds and classes of livestock will be carried, with any additional forage resources most probably allocated to cattle. The BIA and Tribes will develop the final management plans for these and any other customary use areas/allotments, with the BIA establishing base stocking rates. Inventories of the native vegetation types will be carried out by the BIA to establish these stocking rates, with Peabody's revegetation monitoring data providing the basis for stocking rates on the reclaimed lands. Reclaimed lands are to be treated as separate pastures by the Tribes and the BIA, the use of which will be facilitated by Peabody's routine fencing of all reclaimed areas. The added benefit of this is that the distribution of animals will be controlled where native range and reclaimed pastures occur within the same customary use area/allotment. Peabody will also work with the Tribe and the BIA to retain or establish fences needed for grazing management. Because of the large proportion of palatable forage in the reclaimed areas as compared to the surrounding native pinyon-juniper and sagebrush-grassland types, animals will be drawn to the reclaimed lands if allowed free-choice between reclaimed lands and native rangeland. Peabody concurs that these pastures be used and managed as separate pastures.

As noted in Chapter 9 "Vegetation Resources" of the Black Mesa Permit Application Package (PAP) and Annual Reports of Vegetation and Wildlife Resources for the Black Mesa and Kayenta Mines for years 1981-1985, stocking rates or available animal units (AU's) of grazing are significantly higher on the reclaimed lands than the native rangeland areas. As noted in Table 18 of Chapter 9, this may be as high as 19 times greater in the spring and 16 times greater in the fall when considering present stocking rates for the pinyon-juniper native vegetation type. The BIA concurs in this low value of grazing potential for the pinyon-juniper type - hence the extensive conversion of the type to herbaceous vegetation in lands adjacent to the leasehold through chaining, cabling, and reseeding. Table 16 of Chapter 9 lists the more common species that occur on the leasehold, including those species identified on reclaimed lands. In comparing vegetation data from Chapter 9 and the revegetation data from the 1980-1985 annual reports, it can readily be seen that a larger proportion of palatable and desirable forage species occur on the reclaimed lands than in the native rangeland types. This is in consideration of varying kinds and classes of livestock and wildlife species. Reclamation success standards presented in Chapter 23, "Revegetation Plan" for production, species diversity, and woody plant density insure that a productive and nutritious balance of forage will be available to the various kinds and classes of livestock, as well as meeting wildlife species needs for food and cover habitat. The species in the various seed mixes as

presented in Chapter 23 were selected for palatability, nutritional value, and other beneficial uses for the various kinds and classes of livestock to be carried on reclaimed lands on the Black Mesa leasehold as well as wildlife species expected to use these lands.

Range livestock and wildlife species require a proper balance of forage nutrition to meet their basic physiological functions. When the quality of forage is above that which is necessary to meet minimum nutritional needs, positive benefits in terms of animal gains and conditioning are realized. This not only improves economic returns but also better allows animals to maintain themselves during seasonal periods when forage quality and quantity is low.

The four nutrients most critical to range livestock production are protein, phosphorus, energy and carotene (Vitamin A). Furthermore, Cook et al. (1977) showed that digestible protein was the best indicator of forage quality and was one of the better nutrients associated with animal gains. Forage nutrient quality is related to the growth stage of the plants and their palatability, and the seasonal variations therein. Proper management then is related to the quantity and quality of range forage during different seasons and sustaining this quantity and quality over time.

Table 1 lists livestock nutrient requirements for energy, phosphorus, digestible protein and carotene (Vitamin A) for the various kinds and classes of livestock to be carried on reclaimed lands. Table 2 lists the nutrient content of the major forage species found on reclaimed areas within the Black Mesa leasehold and of the major species included in the seed mixes presented in Chapter 23. Areas reclaimed prior to the early 1980's are predominated by introduced cool season grasses and forbs and four-wing saltbush (Atriplex canescens). After that period, the composition of native grasses and forbs was increased in the applied seed mixes, with relative increases in the established reclaimed communities. Additionally, since 1985 increasing amounts of warm season grasses, forbs, and shrubs have been added to the mixes. As noted earlier, seed mixes and plantings presented in Chapter 23 list a variety of cool and warm season grasses, forbs, shrubs, and trees to be applied on future reclaimed lands. Introduced species are used for forage utility, species diversity, and erosional stability. The addition of warm season grasses and forbs will improve seasonal variety and forage quality of matured vegetation available both during growing and nongrowing seasonal periods. It can be seen through comparison of Tables 1 and 2 that the forage resources of reclaimed lands will provide forage utility and quality during all seasons. Again, while only maintenance needs may be met during the

TABLE 1

NUTRIENT REQUIREMENTS FOR BEEF CATTLE,
SHEEP, AND ANGORA GOATS[1]

Cattle	Wt. of Animal	Stage	DP (%)[2]	ME (kcal/lb)[3]	P (%)[4]	Carotene (mg/lb)[5]
Cow, Dry	1000 lb	Gestation	4.4	665	0.17	0.16
Cow, w/Calf	1000 lb	First 8 Weeks Lactation	5.4	900	0.22	1.60
Cow w/Calf	1000 lb	Last 12 Weeks Lactation	4.5	700	0.20	1.60
Sheep						
Ewe, Dry	154 lb	First 15 Weeks Gestation	4.9	900	0.21	0.35
Ewe, Dry	154 lb	Last 6 Weeks Gestation	5.2	950	0.20	0.80
Ewe w/Lamb	154 lb	First 8 Weeks Lactation	6.2	1000	0.34	0.65
Ewe w/Lamb	154 lb	Last 12 Weeks Lactation	Same as Last 6 Weeks Gestation			
Angora Goats						
Doe, Dry	60 lb	-	4.9	1000	.19	-

[1]Sources: Cattle - Cook et al. (1977)
Sheep - Jurgens (1974)
Goats - Leviness, personal communication (1987)

[2]Digestible protein as a percentage of forage intake.

[3]Metabolizable energy in kcal/lb of forage.

[4]Phosphorus as a percentage of forage intake.

[5]Carotene in mg/lb of forage.

TABLE 2

NUTRIENT CONTENT AT VARIOUS STAGES OF GROWTH FOR MAJOR FORAGE SPECIES OCCURRING ON RECLAIMED LANDS AND IN SEED MIXES PRESENTED IN CHAPTER 23 "REVEGETATION PLAN"[1]

Species	Stage of Growth	DP (%)[2]	ME (kcal/lb)[3]	P (%)[4]	Carotene (mg/lb)[5]
Crested wheatgrass	5th leaf	16.2	1325	.27	-
(Agropyron cristatum)	boot	6.6	1083	.23	45.00
	flower	5.9	951	.18	-
	mature	4.0	854	.14	-
	standing cured	3.9	760	.12	00.06
Intermediate wheatgrass	6th leaf	7.7	934	.23	-
(Agropyron intermedium)	flower	6.0	930	.19	65.00
	mature	6.4	1002	.16	-
	standing cured	5.4	802	.14	00.12
Western wheatgrass	4th leaf	5.0	1068	.20	-
(Agropyron smithii)	boot	11.1	1080	.26	60.00
	mature	3.9	1000	.16	-
	standing cured	2.6	995	.10	00.10
Pubescent wheatgrass	5th leaf	11.9	1159	.24	-
(Agropyron trichophorum)	boot	6.8	987	.18	-
	flower	5.8	943	.16	-
	mature	3.8	799	.11	-
	standing cured	3.2	750	.10	-
Little bluestem	vegetative	8.2	1401	.26	65.40
(Andropogon scoparius)	boot	5.9	-	.21	25.10
	mature	5.2	-	.16	-
	standing cured	3.2	-	.11	00.08

TABLE 2 (Continued)

NUTRIENT CONTENT AT VARIOUS STAGES OF GROWTH FOR MAJOR FORAGE SPECIES OCCURRING ON RECLAIMED LANDS AND IN SEED MIXES PRESENTED IN CHAPTER 23 "REVEGETATION PLAN"[1]

Species	Stage of Growth	DP (%)[2]	ME (kcal/lb)[3]	P (%)[4]	Carotene (mg/lb)[5]
Fourwing Saltbush	vegetative	9.4	1180	.21	65.00
(Atriplex canescens)	mature	6.5	1060	.19	25.00
	standing cured	5.8	847	.10	18.01
Shadscale	vegetative	9.1	918	.17	25.00
(Atriplex confertifolia)	mature	8.1	920	.14	22.00
	standing cured	4.4	916	.06	-
Sideoats grama	vegetative	4.4	1145	.22	25.15
(Bouteloua curtipendula)	boot	3.5	1167	.20	-
	mature	1.8	990	.17	10.00
	standing cured	1.8	930	.18	00.05
Blue grama	vegetative	5.8	1364	.26	-
(Bouteloua gracilis)	boot	5.5	1350	.18	31.00
	mature	4.2	1117	.15	-
	standing cured	3.4	909	.14	00.75
Smooth brome	vegetative	8.6	1914	.36	65.15
(Bromus inermis)	flower	6.6	1807	.27	-
	mature	4.7	1770	.24	04.40
	standing cured	3.0	1010	.17	00.18
Russian wildrye	vegetative	8.1	960	.16	60.00
(Elymus junceus)	boot	7.4	900	.15	-
	mature	5.2	850	.14	-
	standing cured	3.0	820	.14	01.10

TABLE 2 (Continued)

NUTRIENT CONTENT AT VARIOUS STAGES OF GROWTH FOR MAJOR FORAGE SPECIES OCCURRING ON RECLAIMED LANDS AND IN SEED MIXES PRESENTED IN CHAPTER 23 "REVEGETATION PLAN"[1]

Species	Stage of Growth	DP (%)[2]	ME (kcal/lb)[3]	P (%)[4]	Carotene (mg/lb)[5]
Winterfat	vegetative	9.0	960	.27	35.00
(Ceratoides lanata)	boot	8.2	842	.18	25.00
	mature	6.1	749	.19	20.00
	standing cured	6.0	488	.14	5.00
Galleta	vegetative	5.6	845	.20	-
(Hilaria jamesii)	boot	5.4	845	.06	-
	mature	4.4	621	.12	25.00
	standing cured	1.9	429	.08	00.92
Summer cyprus	vegetative	13.5	1178	.36	-
(Kochia scoparia)	boot	16.7	1034	.34	-
	mature	14.3	836	.23	-
	standing cured	7.9	710	.13	-
Alfalfa	vegetative	12.6	1125	.31	96.00
(Medicago sativa)	early bloom	10.2	956	.28	56.00
	milk	8.6	891	.22	44.00
	mature	7.4	670	.18	36.00
Sweetclover	vegetative	12.7	1050	.26	70.00
(Melilotus spp.)	mature	7.0	614	.17	9.10
Indian ricegrass	vegetative	9.0	1276	.26	35.00
(Oryzopsis hymenoides)	flower	5.6	992	.25	00.40
	mature	4.2	851	.15	-
	standing cured	1.4	760	.09	00.09

TABLE 2 (Continued)

NUTRIENT CONTENT AT VARIOUS STAGES OF GROWTH FOR MAJOR FORAGE SPECIES OCCURRING ON RECLAIMED LANDS AND IN SEED MIXES PRESENTED IN CHAPTER 23 "REVEGETATION PLAN"[1]

Species	Stage of Growth	DP (%)[2]	ME (kcal/lb)[3]	P (%)[4]	Carotene (mg/lb)[5]
Russian thistle	vegetative	15.5	1057	.20	98.00
(Salsola iberica)	flower	12.9	911	.15	15.00
Bottlebrush squirreltail	vegetative	9.0	1182	.24	25.00
(Sitanion hystrix)	boot	8.2	1169	.24	-
	mature	3.9	1169	.14	00.05
	standing cured	2.2	691	.08	00.04
Alkali sacaton	vegetative	5.3	950	.24	45.00
(Sporobolus airoides)	flower	4.2	890	.22	-
	mature	3.4	880	.14	25.00
	standing cured	1.4	750	.08	00.67
Sand dropseed	vegetative	5.4	1090	.24	46.00
(Sporobolus cryptandrus)	boot	4.2	973	.22	-
	mature	3.9	933	.10	00.52
	standing cured	1.6	913	.05	00.61
Scarlet globemallow	vegetative	12.2	1344	.18	-
(Sphaeralcea coccinea)	full leaf	9.4	1270	.18	-
	mature	8.1	1264	.15	-
	standing cured	6.6	928	.15	-

[1] Source - Cook et al. (1977)

[2] Digestible protein as a percentage of forage intake.

[3] Metabolizable energy in kcal/lb of forage.

[4] Phosphorous as a percentage of forage intake.

[5] Carotene in mg/lb of forage.

winter season, forage resources available during the growing seasons will provide animal gains and conditioning benefits to livestock that may be drawn upon during lean periods.

To insure the continued availability and sustained productive capability and utility of the reclaimed lands for livestock and wildlife as previously discussed, grazing management must be applied to reclaimed lands, as on any native rangeland resource. Discussions with Leo Beno (personal communication, October 1987) indicate that livestock will be carried year-round on the customary use area/allotments with the same goals and objectives of livestock production as discussed earlier in this chapter. In order to adequately achieve this, the following grazing management system should be applied to reclaimed lands on the Black Mesa leasehold.

Two types of grazing management should be applied to reclaimed lands, continuous year-long grazing with restrictions and deferred rotation grazing. Continuous year-long grazing is only suggested as a short-term management alternative prior to development and implementation of the preferred management system of deferred rotation grazing. Continuous year-long grazing should not be practiced any longer than three years for each customary use area/allotment. Additionally only moderate grazing pressure with 40 percent or less of the herbage removed, should be applied. Crider (1955) found that stand deterioration and detrimental physiological affects such as cessation of root growth of forage plants will not generally occur under continuous grazing when only 40 percent or less of the herbage is removed. However, if continuous year-long grazing under heavy pressure is practiced over the long term, essential physiological and morphological requirements of the forage plants will seldom be met. This continuous defoliation during the growing period results in carbohydrate reserve depletion and root growth reduction or cessation. Plant tillering, reproduction, seedling establishment, and seedling survival are all negatively affected. The result is a downward trend in condition of the range resource that is difficult to reverse unless severe measures are taken. In a review of the literature on proper forage utilization, Hedrick (1958) found that continued early, heavy, and frequent forage removal resulted in serious declines in plant vigor and sustained forage production. Cook and Stoddart (1963 and 1964) found that shrubs will not handle heavy use during growth periods and that continued use during this period will result in reduced vigor or eventual loss of these species. Ogden (1980) in a review of the literature on meeting physiological plant requirements found that severe and sustained herbage removal during reproduction stages resulted in the greatest damage to the health and vigor of plants. This has resulted in deteriorating range condition and declining

trend of the native rangeland resources in the Black Mesa area. Periodic deferral of grazing during the growing season, in conjunction with proper grazing use, should maintain a viable, sustainable, and productive forage base. It will also reverse declining trend and improve the range condition over time for the native rangeland areas.

Deferred rotation grazing is the recommended long term grazing management system for a number of reasons. Hickey (1977) in a review of the literature on grazing management systems found that deferred rotation grazing provided benefits to livestock gains, pasture improvement (both vegetation and soils), and net returns. In terms of applied management, the deferred rotation system is most feasible for implementation when considering development and application requirements. Since reclaimed areas will be fenced separately from the native grazing lands, capital improvement costs and labor have already been reduced. Animals will be maintained longer in each pasture than the more intensive management systems such as short duration or high intensity-low frequency grazing systems. This puts less handling stress on livestock, reduces time and management inputs by the operator, and reduces capital costs. Though less fencing is required with a deferred rotation system when compared to the more intensive systems, a minimum of three pastures should be established for this system to provide the desired results.

Deferred rotation grazing provides for the deferment of at least one pasture during the growing season each year. Ideally, pastures are cycled through in a rotation until they have all been alternately deferred during the growing season. Stocking rates are conservatively based on the total pasture area and are based on proper use factors. Deferrment periods generally run three to six months depending on the growing season and number of available pastures. For the Black Mesa leasehold, a four month deferrment period would be well suited to the needs of the grazing lands while providing desired benefits to the operator. Recommended seasons using a four month deferral are spring-summer (March, April, May, June), summer-fall (July, August, September, October) and fall-winter (November, December, January). Cool season species are benefited during the spring-summer deferral because plants are allowed to complete the phenological stages of growth, replenish carbohydrate reserves, and provide mature seed that may be "seeded" by livestock trampling in the following season when grazing occurs. Wildlife are also provided an area where livestock competition is eliminated. Deferrals during the summer-fall season provide similar benefits to warm season vegetation species and wildlife as well as providing a good forage base for fall-winter grazing. Deferral during the fall-winter season will reduce the physical impacts of continuous herbage removal and

livestock trampling as well as providing areas for wildlife without competition from livestock. The periods of most dependable precipitation and annual plant growth coincide with the spring-summer and summer-fall deferral seasons. As an example, in a three pasture system, an individual pasture will be deferred during one or the other growing season every two years.

Grazing pressure of deferred pastures during the dormant season may periodically be heavier without long-term affects on the forage plants. Because of a more uniform composition of forage plants in the reclaimed areas, when compared to native stands, more uniform grazing pressure will be achieved. Periodic heavy stocking will insure adequate forage utilization, reduction in "wolf plants" (i.e., unpalatable clumps of standing dead litter) and stimulation of herbage growth during the next growing season. Ogden (1980) reported a number of researchers' results where pastures were deferred during the growing season and grazed during dormant periods. Lateral bud and shoot growth, tillering, and increased leafy herbage and yields were improved for a number of species. Crested wheatgrass (Agropyron cristatum), a common species in older reclamation, is known to be benefited in terms of improved herbage quality and quantity with proper removal of top growth.

Overall grazing distribution can be insured within each customary use area/allotment by the establishment of a minimum of three pastures within each and the rotational use of these pastures during the year. Within each pasture, distribution may be controlled by salting locations, placement of water resources, herding, and topography. Because of the relatively gentle terrain in the reclaimed areas, as compared to the native rangeland areas, topography may only present problems to distribution in the native areas. All salting stations can be located in the pastures in a manner that maximizes distribution and should not be placed near water sources or key habitat for wildlife. On gently rolling range, salting stations may be 1½ to 2 miles apart, with no more than ½ to 1 mile apart on rough range (USDA-SCS, 1976). The number of stations should be determined by pasture size, topography, and the type and number of livestock. Proper development and location of water supplies are essential for proper livestock distribution and grazing management. Every effort should be made to maximize and diversify water developments in the pastures, including all potential sources related to mining and reclamation activities. Where several water sources exist in a pasture or where portable water tanks are used, distribution can be controlled by restricting access to certain permanent water sources or by relocating the watering area when using portable tanks. This may be done at

different times throughout the grazing season. Herding or "pushing" animals into under utilized forage resource areas should be practiced on a regular basis. This will be more necessary for sheep and goats than for cattle.

In summary, long term grazing management should be achieved through coordination of information between the pertinent agencies and Peabody, a deferred rotation grazing system, and proper grazing use. In some cases, continuous year-long grazing, at 40 percent utilization or less, may be carried out for a maximum of 3 years while the deferred rotation management system is established. As reclaimed lands are released of bond, they can be incorporated into customary use areas/allotments. It is anticipated that sufficient acreage will be released at any given time such that it may incorporate several of the customary use areas/allotments. Prior to plan implementation, inventories of fences, viable water sources, roads, and special use or unique habitat areas should be made and the results evaluated for integration or consideration. Stocking rates and forage composition information from Peabody's revegetation monitoring can be made available to the Tribes and BIA for integration with stocking rate and forage composition information from inventoried native lands. Pasture units should be established and fenced based on operator needs, topography, location of water resources, and relative contributions of reclaimed to native grazing lands available in each customary use area/allotment. Because of the size and number of pastures and the many customary use areas and allotments, hauling of stock water will most probably still need to be done in some areas. This will be much improved over previous premining situations because of the availability of the N-aquifer wells, the well distributed public watering facilities, other developed well sources, and a number of large viable water storage reservoirs such as the various MSHA impoundments. A minimum of three pastures should be established. The pasture sizes, rotation system, and pasture deferrals will be determined by the operator, BIA and Tribal personnel responsible for grazing management on Tribal lands. Due to the possibility of severe inclement weather during winter months, the operator should make provision for a short term supplemental feeding program. Grazing of pastures during the growing season should not be heavier than 50-60 percent utilization or a proper use factor determined by the BIA or Tribal representatives. These representatives will be able to provide simple and quick methodologies for determining proper use levels to the operators. Periodic heavier use during the dormant season may be practiced and will provide benefits to pastures as previously discussed. Increased water sources, improved and sustained forage production, and availability of lands excluding livestock during pasture deferrals will provide positive benefits to wildlife species. Native grazing lands incorporated

into areas covered by the Grazing Management Plan should receive proper management and declining range condition and trend should be reversed.

The Grazing Management Plan should be evaluated on an ongoing basis. Thus, customary use areas/allotments where the management plan has been implemented may be evaluated for effectiveness and practicability. Since customary use areas/allotments will be established on a continuing basis as newly released reclaimed lands are returned to the Navajo Tribe, necessary changes or adjustments in the plan and its implementation can be made based on the ongoing evaluations. Peabody will be available on an advisory basis to assist in the evaluation and any necessary adjustment of the plan.

This grazing management plan for reclaimed land units is a program of action designed to achieve specific objectives. The following objectives were considered during the development of this plan: 1) secure proper and sustained utilization of the forage resource; 2) avoid unnecessary impacts to related resources (wildlife, soils, watersheds, aesthetics); 3) insure compatibility with existing native resources, the management skills of operators and existing classes of livestock; 4) obtain uniform use of the forage resource through proper distribution of livestock; 5) provide for a stable forage supply (quantity and quality) throughout the grazing season; and 6) improve range condition on adjacent native ranges through reduced grazing pressure. Coordination between the various agencies, proper stocking, and the deferred rotation grazing system described herein should insure that the objectives are being met. Theoretically, the plan (with any necessary modifications or adjustments) should be functionally accurate for an indefinite period of time if properly administrated.

Postmining Water Sources

Pre-existing water sources for livestock and wildlife are shown on Drawing 85322. A description of these water sources and an assessment of mining related impacts is contained in Chapters 15, 17, 18, and 23.

Five types of water sources for wildlife and livestock will exist or are being proposed in the postmining landscape. They include pre-existing springs, wells (pre-existing and replacement), pre-existing intermittent reaches of ephemeral washes, public water standpipes, and ponds. The ponds include pre-existing surface water structures, existing pre-law internal impoundments, existing and proposed postlaw internal impoundments, and

existing and proposed sediment control structures. The water sources are shown on Drawing 85324. This section discusses the adequacy of these water sources (water volumes, distribution, and viability) to support the proposed postmining land uses.

The locations, sources, yields, and assessments of water quality for the springs existing within or adjacent to the leasehold are contained in Table 51, Chapter 15 and Table 3, Chapter 17. The water quality information is qualitative in nature and is the only information available from the period when these springs flowed. With the possible exceptions of springs DM-20 and 8A-144 or 8A-145, these springs are currently dry or exist only as damp spots. This is not surprising as springs are sensitive to climatic and ground water fluctuations. Springs DM-20 and 8A-144 or 8A-145 probably correspond to Peabody monitoring site numbers 140 and 91, respectively. A discussion of the currently flowing springs on the leasehold is contained in Chapter 15 (p. 269). These springs exhibit variable discharge. Water from these springs is classified as poor to unsatisfactory for livestock use based upon discrete observations of any suitability parameter exceeding the standards used for comparison. An examination of the spring water quality data contained in Chapter 15 and additional data collected in 1986 and 1987 (see the respective Hydrologic Data Reports) with regard to mean values for the period of record support the conclusion contained in the PAP. Therefore, the springs shown on Drawing 85324 are relatively poor sources for livestock drinking water due to: 1) variable or diffuse discharge (short term); 2) inconsistent discharge (long term); and 3) poor water quality.

Pre-existing well water quality and quantity is dependent upon the aquifer(s) penetrated. Aquifer water quality and yield, and local well completion information are discussed in Chapter 15 (various sections - see Index) and Chapter 17 (Page 8, Table 2 and Table 6). To Peabody's knowledge, none of the local wells on the leasehold are operable with the possible exception of Well 8T-504. This well is known to be completed in the Toreva formation. The Toreva formation yields good water quality at a sufficient rate for livestock use. The replacement wells that Peabody has proposed will also be completed in the Toreva formation and will yield adequate amounts and quality of water for livestock use. Well 4T-402, located between the east and west leasehold tracts, is completed in the Dakota aquifer, but is currently inoperable. The status of the other off-lease local wells shown on Drawing 85324 is unknown, but it is assumed they are still operable. The remaining local wells (see Drawing 85324) cannot be considered viable livestock drinking water sources because they are inoperable or do not exist. Those completed in the

alluvium and Wepo aquifer would also possess poor to unsatisfactory water quality and yield, should they be made operable.

Water quality and discharge information related to the intermittent reaches of the washes is discussed in Chapter 15 (Page 49 and Page 211) and Chapter 17 (Page 23 and Table 6). The intermittent reaches are caused primarily from daylighting of the alluvial ground water. Certain chemical parameters in the alluvial ground water and in stream flows exceed the livestock drinking water standards from time to time, which would render the water poor to unsuitable for livestock uses. However, when long term mean concentrations are considered, the water is generally suitable for livestock use. An examination of additional stream flow data contained in the 1986 and 1987 Hydrologic Data Reports supports this observation. Based upon Peabody's period of record pertaining to the extent and fluctuations of the intermittent reaches (see Drawing 85324) and the available water quality data, it appears that these water sources are viable. Considerable use of these sources has been observed on the leasehold, reflecting upon their relative importance.

The public water standpipes (see Drawing 85324) provide sources of drinking, general use and livestock water. Water is routinely hauled to local residences for use in troughs at the corrals and sheep pens. This water is available on a 24-hour basis and is potable.

Peabody has no information regarding the water quality or viability of pre-existing surface water structures. These structures were built on very small watersheds, and their water holding capacity is slight. Water quality is presumed to be sufficient for livestock uses during the short durations that these structures impound water.

Nineteen permanent internal impoundments currently exist that are available for livestock and/or wildlife use as a part of the postmining landscape (Drawing 85324). Two livestock and wildlife sources (N2-RB and N2-RC) and one wildlife habitat area (N2-RA) are approved, permanent, internally draining ponds located in the N-2 coal resource area. Sixteen are pre-law internal impoundments located in the J-3 coal resource area (J3-G and five other unnamed impoundments), J-1 coal resource area (two unnamed impoundments), N-8 coal resource area (one unnamed impoundment), and N-1 coal resource area (seven unnamed impoundments). Additional pre-law depressions exist that hold water from time to time. However, they are not considered reliable water sources due primarily to restricted watersheds.

The water chemistry at the N2-RA impoundment is principally controlled by the N-2 mining area spoil aquifer water quality as the pond intercepts a portion of the spoil aquifer. As a result, total dissolved solids concentrations in the pond infrequently meet livestock drinking water standards; although, interception of ground water provides excellent water quantity and persistence. The perennial water supply provides valuable resting and feeding habitat for migratory birds. Such conditions did not exist in this area prior to mining. For these reasons, N2-RA is designated for wildlife habitat use and not livestock use. The immediate area of the pond has been fenced to prevent livestock access.

Peabody is also proposing to build two additional internal impoundments in the J-19/21

THIS PAGE INTENTIONALLY LEFT BLANK

coal resource area. These structures are intended to improve the distribution of postmining water sources in that area of the leasehold (see Drawing 85324).

Peabody also proposes the retention of 28 existing and future sediment control structures (ponds) to provide surface water bodies for livestock and wildlife in addition to those previously identified. The proposed facilities include eight existing MSHA structures which include J-7, J2-A, J16-L, J16-A, N-14H, N14-G, N14-F, and N14-D. Eleven smaller existing sediment control structures are also proposed. They include J3-D, J3-E, N5-A, TPF-D, TPF-A, N7-D, J16-G, N7-E, N10-A1, N10-D, and N12-C. Nine sediment ponds scheduled for construction during the remaining life-of-mining activities are also proposed and include N6-K, N11-A, N11-G, N10-G, J7-R, J7-JR, J21-A, J21-C, and J21-I. These existing and proposed ponds all meet or will be upgraded to meet the permanent pond design criteria. Their size, configuration, and upstream watersheds indicate persistent water retention (see the discussion of Permanent Impoundments, Chapter 6 and Appendix D). They will also provide water of good quality for their intended uses based upon analysis contained in Chapter 15 and evaluation of additional water quality data collected in 1986 and 1987 (see these respective Hydrologic Data Reports).

Based upon the previous discussion and comparison of Drawings 85322 and 85324, it can be seen that considerably more water sources with much greater viability will exist in the postmining landscape. The distribution of the viable pre-existing sources will be greatly enhanced with the addition of replacement ponds and wells, public water standpipes, and enhancement ponds.

Land Use Summary

In summary, the postmining land uses of livestock grazing and wildlife habitat represent no change from the premining land uses. The postmining land uses will be achieved through implementation of the reclamation plan discussed in detail elsewhere in this document. The management plan for postmining lands consists of the reclamation plan including revegetation maintenance activities. No formal land use plans or policies have been developed by land management agencies specific to the Black Mesa leasehold. Therefore, the reclamation plan has been designed to produce lands which will be compatible with and will support the existing land uses. The reclamation plan has been previously approved by the Bureau of Indian Affairs and the Navajo and Hopi Tribes (see Permit Application Approval Packages for Permits AZ-0001, AZ-0002 and AZ-0002A).

OSMRE regulations at 30 CFR 780.23(b) require that the description of postmining land use contained in a Permit Application Package be accompanied by a copy of the comments concerning the proposed land use by the land owners and the government agency which would have to approve the proposed use. As stated in Chapter 3, the owners of the land to be disturbed and adjacent areas are the Navajo and Hopi Tribes. The land management agency is the Bureau of Indian Affairs.

The OSMRE has entered into cooperative agreements with the Navajo and Hopi Tribes which require the Tribes to assist OSMRE in analyzing and reviewing reclamation plans including the preparation of Technical and Environmental Assessments. Through these agreements, comments concerning land use are provided by the Tribes to OSMRE. Further, OSMRE has provided complete copies of the Permit Application Package to the Bureau of Indian Affairs for review and comment. Peabody believes this review process and the cooperative agreements satisfy the intent of 30 CFR 780.23(b) in that comments from the land owners and land management agency regarding postmining land use will be provided to OSMRE.

Literature Cited

Arizona Division, PCC. Vegetation and Wildlife Resources 1981 Report: Black Mesa and Kayenta Mines. Report prepared for: USDI, Office of Surface Mining, Western Technical Center, Denver, Colorado. 1982.

Arizona Division, PCC. Vegetation and Wildlife Resources 1982 Report: Black Mesa and Kayenta Mines. Report prepared for: USDI, Office of Surface Mining, Western Technical Center, Denver, Colorado. 1983.

Arizona Division, PCC. Vegetation and Wildlife Resources 1983 Report: Black Mesa and Kayenta Mines. Report prepared for: USDI, Office of Surface Mining, Western Technical Center, Denver, Colorado. 1984.

Arizona Division, PCC. Vegetation and Wildlife Resources 1984 Report: Black Mesa and Kayenta Mines. Report prepared for: USDI, Office of Surface Mining, Western Technical Center, Denver, Colorado. 1985.

Arizona Division, PCC. Vegetation and Wildlife Resources 1985 Report: Black Mesa and Kayenta Mines. Report prepared for: USDI, Office of Surface Mining, Western Technical Center, Denver, Colorado. 1986.

Beno, Leo. Reclamation Specialist, Navajo Department of Surface Mining. Personal communication, October 15, 1987.

Bureau of Indian Affairs. Summary Report Soil and Range Inventory of the 1882 Executive Order Area (Exclusive of District Six) Arizona (includes map atlas). USDI, BIA Branch of Land Operations, Window Rock, Arizona. 1964.

Bureau of Indian Affairs. Trail Dust. USDI, BIA, Western Navajo Agency, Branch of Land Operations, Newsletter No. 5, Tuba City, Arizona. September 1983.

Clary, W.P. "Present and Future Multiple Use Demands on the Pinyon-Juniper Type." In: The Pinyon-Juniper Ecosystem: A Symposium. Utah State University, Logan, pp. 19-24. 1975.

Cook, C.W., R.D. Child, and L.L. Larson. "Digestible Protein in Range Forages as an Index to Nutrient Content and Animal Response." Range Science Department Series No. 29. Colorado State University, Fort Collins, Colorado. 1977.

Cook, C.W. and L.A. Stoddart. "The Affect of Intensity and Season of Use on the Vigor of Desert Range Plants." Journal of Range Management 16:315-317. 1963.

Cook, C.W. and L.A. Stoddart. "Spring Grazing Critical to Desert Ranges." Utah Farm and Home Science. 23:6-7, 25-26. 1964.

Crider, F.J. "Root-growth Stoppage Resulting From Defoliation of Grass." USDA Technical Bulletin No. 1102. 1955.

Deaver, C.F. and H.S. Haskell. Pinyon Resources - Distribution of Pinyon (Pinus edulis), Yield and Resin Potentialities Navajo-Hopi Reservations, Arizona-Utah. University of Arizona Press, Tucson. 1955.

Everett, R.L., Compiler. "Proceedings - Pinyon-Juniper Conference." USDA, Forest Service, Intermountain Research Station General Technical Report No. INT-215. 1987.

Hedrick, D.W. 1958. "Proper Utilization - A Problem in Evaluating the Physiological Response of Plants to Grazing Use: A Review." Journal of Range Management. 11:34-43. 1958.

Henderson, D.E. and M.L. Baughman. "Whole Tree Harvesting of the Pinyon-Juniper Type: Economic and Institutional Considerations." In: Proceedings - Pinyon-Juniper Conference, R.L. Everett, Compiler. USDA, Forest Service, Intermountain Research Station General Technical Report No. INT-215, pp. 192-195. 1987.

Hickey, W.C. "A Discussion of Grazing Management Systems and Some Pertinent Literature (Abstracts & Excerpts) 1895-1966. USDA-USFS, Rocky Mountain Regional Office. 1977.

Johnson, C.M. "Pinyon-Juniper Forests: Asset or Liability." In: The Pinyon-Juniper Ecosystem: A Symposium. Utah State University, Logan, pp. 121-124. 1975.

Jurgens, M.H. Applied Animal Feeding and Nutrition, An Outline. Kendall/Hunt Publishing Co., Dubuque. 1974.

Kelley, K.B. Navajo Land Use - An Ethnoarchaeological Study. Orlando, Florida: Academic Press, Inc. 1986.

Kiersch, G.A. Mineral Resources Navajo-Hopi Indian Reservations, Arizona-Utah, Vol. 1: Metalliferous Minerals and Mineral Fuels. University of Arizona Press, Tucson. 1956.

LeBaron, A. Estimating Profits From Sales of Pinyon-Juniper Products. Utah Agricultural Experiment Station Resource Series 43. 1968.

Leviness, E. Livestock Specialist, Coconino County Cooperative Extension Service. Personal communication, October 27, 1987.

Little, E.L., Jr. "Managing Woodlands for Pinyon Nuts." Chronica Botanica. 16:348-349. 1941.

Murphey, P.M. "Specialty Wood Products From Pinyon-Juniper." In: Proceedings - Pinyon-Juniper Conference, R.L. Everett, Compiler. USDA, Forest Service, Intermountain Research Station General Technical Report No. INT-215, pp. 166-167. 1987.

Ogden, P.R. "Meeting the Physiological Requirements of a Plant with Grazing Systems." In: Proceedings - Grazing Management Systems for Southwest Rangeland Symposium. New Mexico State University, Las Cruces, pp. 37-48.

Ronco, F., Jr. "Stand Structure and Function of Pinyon-Juniper Woodlands." In: Proceedings - Pinyon-Juniper Conference, R.L. Everett, Compiler. USDA, Forest Service, Intermountain Research Station General Technical Report No. INT-215, pp. 14-22. 1987.

Springfield, H.W. "Characteristics and Management of Southwestern Pinyon-Juniper Ranges: The Status of Our Knowledge." USDA, Forest Service, Rocky Mountain Forest and Range Experiment Station Research Paper No. RM-160. 1976.

Stoddard, L.A. and Smith, A.D. Range Management. New York: McGraw-Hill Book Company. 1955.

USDA, Soil Conservation Service. National Range Handbook. U.S. Government Printing Office, Washington, D.C. 1976.

Wood, J.J., Vannette, W.M. and M.J. Andrews. A Sociocultural Assessment of the Livestock Reduction Program in the Navajo-Hopi Joint Use Area. USDI, Bureau of Indian Affairs, Flagstaff Administrative Office. Contract Number K01C14200739. 1979.

ATTACHMENT 1

SOIL CONSERVATION SERVICE CORD WOOD ESTIMATES

FOR RESIDUAL SOILS OCCURRING ON THE BLACK MESA LEASEHOLD

United States Department of Agriculture
Soil Conservation Service
Diamond Hill, Bldg A, 3rd Floor
2490 West 26th Avenue
Denver, Colorado 80211

May 3, 1985

Richard Trenholme, President
Intermountain Soil Inc.
1873 S. Bellaire Street, Suite 330
Denver, Colorado 80222

Dear Mr. Trenholme:

In your request regarding potential plant communities on the soils you submitted, the following is provided.

On the dry phase for the Mikim, Cahona, Pulpit and Sharps series annual precipitation ranges from 10 to 14 inches. The dry phase is placed in the semidesert loam range site. In addition to lower production Galleta (Hilaria jamesii) is usually present in significant amounts and produces up to 20 percent of the total production when these sites are in excellent range condition.

The moist phase for the above listed soils shows a preciptation range of 14 to 18 inches annually and are placed in the Loamy Foothills Range Site. Also, Galleta produces less than five percent of the total annual production when these sites are in excellent condition.

Only the Dulce and Zyme soil series are considered Pinyon-Juniper sites. On the other soils listed, pinyon and juniper are considered invader species. They normally would not be present if proper management methods are used on these soils.

The preferred method of rating Dulce and Zyme soils for annual production is cords of wood per acre. Site indexes can be used and are also shown in the following table.

Soil Series	Cords/AC	Site Index
Dulce	15	65
Zyme normal slope (3-25%)	12	50
Zyme steep slope (25-60%)	10	45

The Mikim series with the wet substratum is alkaline and is placed in the Salt Flats Range Site. This soil normally has a water table from 3 to 5 feet below the surface during the growing season.

Enclosed are several range site descriptions for additional information. If you have additional questions, please feel free to contact us.

Sincerely,

Leonard Jürgens
Range Conservationist

Enclosure

cc:
Don Gillaspie, SRC, SCS, Denver, CO

ATTACHMENT 2

NAVAJO TRIBE DRAFT LAND USE PLAN FOR THE

BLACK MESA MINING AREA

DRAFT

Revised 3/87

LAND USE PLAN FOR BLACK MESA MINING AREA

INTRODUCTION: The purpose of the land use plan is to promote sound management of reclaimed and adjacent lands. This plan will facilitate and direct the Peabody reclamation plan mandated by SMCRA.

This plan was developed in cooperation with local land users, Navajo Coal Mining office, Peabody Coal Co. and BIA, Branch of Natural Resources, through a series of education meetings held from April, 1985 through March, 1987. The plan will become effective upon approval of BIA Agency Superintendent.

GENERAL INFORMATION: The primary purpose of mine reclamation is to restore mined land to its former productive state or better. Before mining, the Black Mesa area was used primarily for livestock grazing, homesteads, and wildlife habitat. The mined land of this area is currently being reclaimed for livestock grazing and wildlife habitat after the mining activities terminate. The present Peabody water system will remain in place as well as the power transmission lines, except for those determined "to be removed" by the Navajo Tribe. Most fences installed by Peabody will remain. Sediment ponds that are deemed dependable and desirable for stock water will be refurbished. The identified "main" roads will be reduced to pick up roads and others will be reclaimed.

The Planning Area: The area in this plan includes all Navajo lease area and adjacent grazing units surrounding the lease area.

Land Form[1]: The Black Mesa is a large plateau, sloping from summit toward south and southwest. The North edge is a high out facing sandstone cliffs with Lalomai point reaching to 8120 ft. in elevation. The rugged formation has been eroded into a series of parallel ridges and narrow valleys by the principle washes. The Southern part is dissected by Dennehotso, Oraibi, and

Polacca washes into box canyons and gently dipping rock platforms.

Climate[2]: The climate in the vicinity of the lease area is arid-steppe. The area is located in the rain shadow of surrounding mountains and therefore has long dry periods, dry clear air with low humidity, and a high amount of sunshine. The average precipitation is approximately 10 inches occuring primarily in the form of convectional showers during the summer months. Long periods often occur with little or no precipitation. Average temperatures range from about 30°F in January to 75°F in July. The elevation of the mesa which exceeds 7,000 feet in some areas, keeps the location relatively cool. The frost-free period extends for approximately 150 days from mid-May into September. Approximately 6.15 inches of precipitation, on the average, occurs during the May through September growing season. Local farming in the area is not dependent on flood irrigation or subirrigation. Local farm plots grow corn and other crops for household consumption. These plots are dependent on precipitation and in low precipitation years, crops may not be grown.

Data collected in the mine vicinity show the prevailing winds to come from the south and southwest. Limited onsite data confirm this with the majority of wind velocity observations being below 3.5 mph.

Hydrology[3]: Surface Water - The mine area is characterized by steeply-incised intermittent and ephemeral streams which flow generally southwest in a parallel drainage pattern. Coal Mine, Yellow Water Canyon, Moenkopi and Dinnebito Washes are the principal drainages in the area with Moenkopi and Dinnebito Washes being the primary receiving streams and the two main stems of the mine drainage network. Both Moenkopi Wash, which flows throughout the central portion of the leasehold, and Dinnebito Wash, which flows along the southern edge, reach their confluence with the Little Colorado River approximately 50 miles southwest of the lease area. Drainage areas from these intermittent

streams are 121 and 35 square miles, respectively, as they exist in the lease area. There are three major tributaries to Moenkopi Wash upstream of its confluence with Coal Mine Wash: 1. Yucca Flat; 2. Red Peak Valley; and 3. Reed Valley. However, during years of high precipitation, ground-water levels have raised to the point of creating saturated zones or zones having unmeasurable flows. These zones are very limited in extent, variable in location, and occur primarily downstream of the Reed Valley Dam.

Ground Water: The N-aquifer and D-aquifer systems are the regionally significant water-yielding systems. The Black Mesa/Kayenta mine is currently pumping water from these two aquifers, using 8 wells. These wells are 1,869 to 3,626 feet deep. All wells are interconnected, so all or one well can feed the water lines.

On a local basis, ground water in the Wepo and Toreva Formations is present under both water table and artesian conditions. Ground-water potential in the interbedded mudstones, siltstones, sandstones and coals of the Wepo is low.

Thicknesses range from 304 feet near Yale Point to 743 feet east of Cow Springs, with the formation thinning to the northeast. Ground water is primarily obtained from the Toreva Formation and only secondarily from the Wepo Formation. Well yields range from 10-15 gpm and the water is marginal to unsuitable for drinking. Water levels in the Wepo range from a few feet to several hundred feet below the surface. Wells in the Wepo and Toreva range from 436 to 950 feet deep and aquifer thickness ranges from 68 feet (Toreva) to 434 feet (Wepo).

Soils/Vegetation[4]: The soils of the Black Mesa/Kayenta mine are typical of the arid grasslands and woodlands of the Western United States. The influence of the five soil forming factors (time, climate, parent material, living

organisms, and topography) have contributed to a wide variation in the physical, chemical and morphological characteristics of the soils within the mine area. Climate has been the dominant soil forming factor. The hot and dry conditions contribute to slow organic matter accumulation, little physical or chemical weathering, and a high susceptibility to wind and water erosion. Topography and aspect have also strongly influenced soil formation. The coarse textured soils developed from sandstone; the fine-textured soils were derived from shale. Both types of soils are generally shallow with a moderate amount of coarse fragments. The deeper soils have developed from aeolian and/or alluvial materials. They are primarily coarse-textured, though the soils that have been stable for long periods of time have developed a moderately fine-textured subsoil.

The pinyon-juniper woodland is the most abundant vegetation type and is most often located at elevations between 6,700 and 7,200 feet. Colorado pinyon (Pinus edulis), Utah juniper (Juniperus osteosperma), and Gambel oak (Quercus gambelii), are the tree species associated with this vegetation type. The herbaceous shrub layer is composed of graminoids, forbs, sub- and true shrubs. The second most abundant vegetation type is the sagebrush shrubland community and is primarily located on deep, well-drained soils. The two dominant species in this community are big sagebrush (Artemisia tridentata) and Blue grama (Bouteloua gracilis). The third, and least abundant vegetation type is the saltbush shrubland community which occurs mostly in the Reed Valley drainage, at elevations ranging from 6,700 to 6,900 feet. This community is dominated by the fourwing saltbush (Atriplex canescens) with a dense understory of annual forbs often present.

The current reclaimed areas are primary cool season grasslands. The 1985 vegetation analysis shows over 80% cool season species and less than 20% warm

season species. The dominant grass species are wheatgrasses and Russian wild rye. Four winged salt bush is the only primary shrub species. New seeding mixtures include warm season species and additional shrub species.

Grazing Permittees: There are 22 individual grazing use areas on or adjacent to the lease area. The 22 permittees have a combined total of 1132 sheep units permitted.

Customary Use Areas: All of individual customary grazing areas prior to mining will be honored. Most customery use areas have homes, corrals, and other ranch developments. The individual use areas are mapped and planned according to guidelines set in Attachment "A". The bulk of this land use plan are the grazing plans. Each use area is checked for current range conditions, grazing practice and recommended list of improvements. These improvements include a prescribed grazing plan, water developments, fencing and forage improvements.

Soil & Range Data: Soil and range data are on each customary use area maps. The major soil differences are delineated on the maps as needed. The range conditions, problem areas, and reclaimed areas are also outlined on the customary use maps.

Range Improvements: Each grazing unit will have existing improvements drawn on the map. Based on prescribed grazing plans, other improvements will be planned and placed on map as "planned". Cost estimates will be obtained for all improvements planned on areas outside the lease areas. These costs will be combined with costs from other units for funding proposals or requests.

Residential Areas: All permanent residential structures will be identified on the plan maps and grazing plan maps. All proposed home site will also be placed on maps as "planned".

Management Plans: This land use plans will require each permittee to develop management plans. There plans must include the following criteria:

1. Each use area will be mapped on aerial photographs or topographic maps. The map will delineate use boundry, all existing structures and proposed structures; and
2. Each permittee must follow a narrative grazing plan specificially designed by him with assistance from BIA and Navajo Tribe. This plan will ensure that:
   a. In the growing season, the range can produce the maximum amount of high quality forage;
   b. The forage grown in the growing months is sensibly budgeted and rationed through the non-growing months.
   c. The nutritional requirements of the animals are adequately met;
   d. There is a minimum of physical handling stress on the animals, and
   e. There are adequate provisions to enhance wildlife habitat.

FOOTNOTES:

1. 1972 DRAFT EIS, NAVAJO GENERATING STATION, BUREAU OF RECLAMATION
2. PEABODY MINE PLAN, J-21, 1984, PEABODY COAL CO.
3. PEABODY MINE PLAN, J-21, 1984, PEABODY COAL CO.
4. PEABODY MINE PLAN, J-21, 1984, PEABODY COAL CO.