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Jim

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ARCO Coal Company
Permits and Compliance Group
555 Seventeenth Street
Mailing Address: Box 5300
Denver, Colorado 80202
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0014

March 26, 1982

Mr. James W. Smith, Jr.
Coordinator
Mined Land Reclamation
Division of Oil, Gas and Mining
Department of Natural Resources
4281 State Office Building
Salt Lake City, Utah 84114

Dear Mr. Smith:

Attached is the revised Section 9 - Vegetation Resources for the Huntington Canyon No. 4 Mine, Mining and Reclamation Plan. This report reflects an upgraded quantitative vegetation assessment on a new reference area which we feel is more representative of the existing disturbed area at the Huntington Canyon No. 4 Mine. This work was performed in the 1981 field season by Warren Keammerer of Stoecker Keammerer and Associates Boulder, Colorado.

This replaces the previous consulting work performed by Espey, Huston and Associates in the 1980 field season.

If you or your staff should have any questions concerning the revised vegetation resources report, please contact Gregg Squire at 303/575-7590 or myself at 303/575-7548.

Sincerely,

David R. Chenoweth
Coordinator
Permits and Compliance

cc: Carbon County Court House
Dick Daws /OSM

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Section 9

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VEGETATION RESOURCES

9.1 Scope

The vegetative resources data information for the Huntington Canyon No. 4 Mine was prepared by Beaver Creek Coal Company based upon studies performed by Espey, Huston and Associates, Inc. during July, August and September 1980. The study area included the entire 1,320 acre lease area located in Emery County approximately 29 miles southwest of Price, Utah.

The major components of the study were the preparation of a vegetation map of the permit area, a qualitative and quantitative description of the vegetation within the study area, and the establishment of a vegetative reference area. The study also included a site wide examination to identify any threatened or endangered species which may be present on the lease area.

Based on a review of the results of those studies, it was decided by ARCO Coal Company personnel that some additional information was needed to supplement the initial work. The scope of work to be accomplished during 1981 was discussed with the Utah Division of Oil, Gas and Mining (DOG M) in early July in order to obtain their input and approval of the studies were appropriate and would be acceptable to them.

The 1981 studies performed by Stoecker-Keammerer and Associates consisted of obtaining cover, frequency, and production data for a pinyon-juniper woodland reference area at the Huntington Canyon No. 4 Mine.

All the data were collected during the second week of July, 1981.

MINING AND RECLAMATION PLAN
HUNTINGTON CANYON NO. 4 MINE

9.2 Methodology

9.2.1 Floristics

A floristic survey was conducted at the same time as the 1980 quantitative vegetation sampling. The purpose of the floristic survey was to determine and list the plant species present within the lease area including any threatened or endangered species. This was accomplished by a walking reconnaissance of the mine area noting species occurrence and their distribution in the various communities.

9.2.2 Vegetation Map

A vegetation map (see Plate 9-1) of the Huntington Canyon No. 4 Lease Area and adjacent areas was prepared from black and white aerial imagery obtained from ARCO Coal Company. Community types were delineated based on two or more dominant species. The vegetative types were also quantified in terms of acreage and percentage of the study area. Sampling locations, both reference and affected area, are indicated on the map. The community types recognized as being of sufficient extent to warrant separation into individual communities are pinyon-juniper woodland, Douglas-fir, sagebrush-grassland and oak shrubland. Burned over areas were also mapped. Only the pinyon-juniper woodland community occurs in the area of disturbance. A field proofing of this map, and possible revisions will be done during the Spring 1982 field season.

MINING AND RECLAMATION PLAN
HUNTINGTON CANYON NO. 4 MINE

9.2.3 Reference Area

Reference areas are land areas that are selected to represent the species composition, topography, soils and aspect of the permit area. A reference area on the mine was selected by the ocular method, i.e., by visual comparisons of the above attributes to that of the affected area, and by examining topographic and soils maps. The reference area selected in the 1981 study was located within the permit area on a site which would not be disturbed throughout the life of the mine. The reference area was one hectare (2.5 acres) in area (200m by 50m) and was selected to be characteristic of the vegetation type it portrayed (Plate 9-1).

9.2.4 Vegetative Cover and Production

The only vegetation type which has been affected by mining operations is pinyon-juniper therefore only this type was quantitatively sampled for cover and productivity. All surface disturbances at this mine have taken place, no further disturbance is planned. Therefore quantitative surveys on affected areas and other vegetation types were not deemed necessary.

9.2.4.1 Cover

Cover data were collected using a quadrat approach. Individual 1.0 m² quadrats were randomly located in the reference area. Random sampling was accomplished by using pairs of random coordinates. The first number of the pair was the measured distance along one side (long axis) of the reference area, and the second number was the paced distance perpendicular to the tape at the position of the first number. Random sampling locations within each of the reference areas are shown in Figure 9-1. In

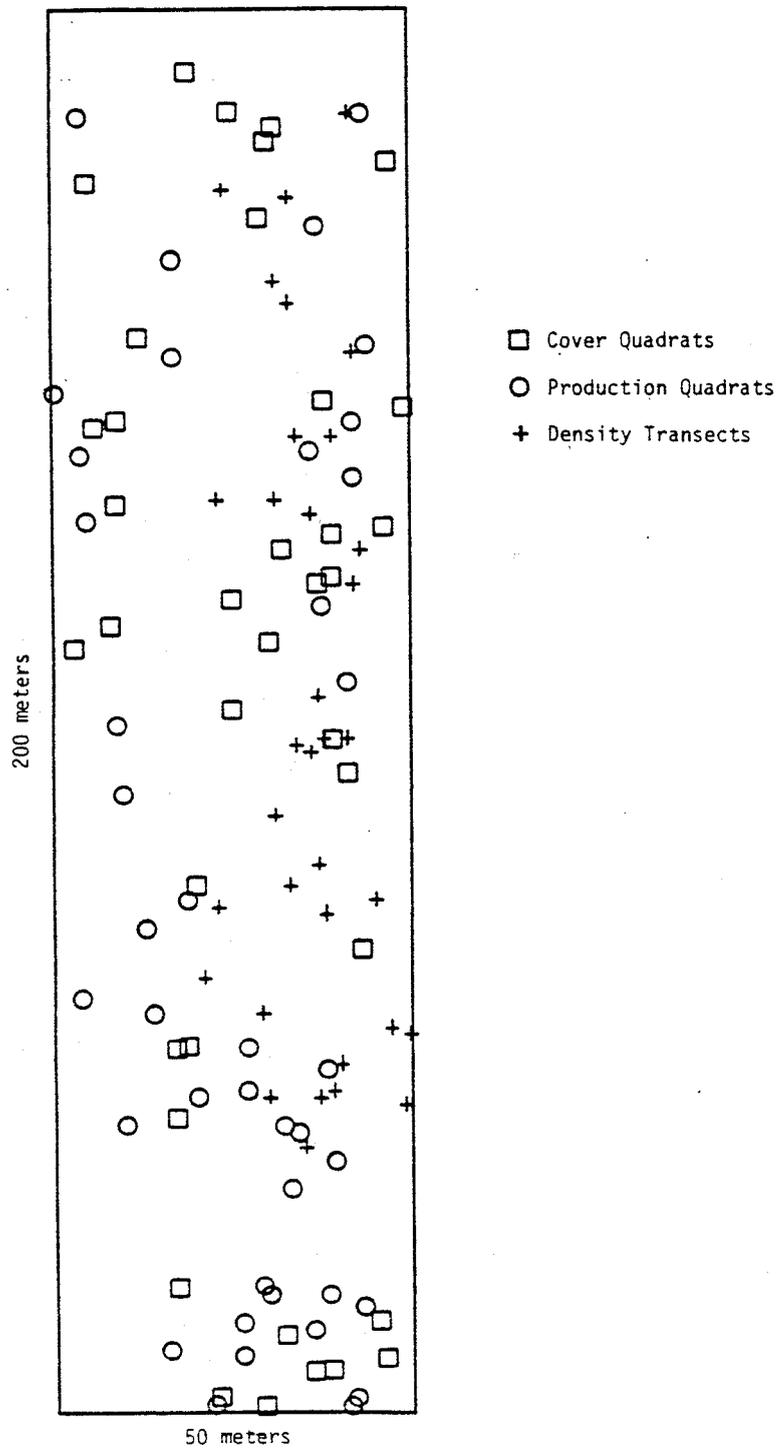


Figure 9-1. Sampling locations in the Pinyon-Juniper Woodland Reference Area at Huntington Canyon No. 4 Mine

MINING AND RECLAMATION PLAN
HUNTINGTON CANYON NO. 4 MINE

9.2.4.1 Cover (continued)

each quadrat, total vegetation cover (canopy cover) including shrub canopy, cover by bare soil, and cover by litter and rock were visually estimated. For each quadrat these three components added to 100 percent. Canopy cover for each species and cover by litter, rock, bare soil, lichens, and mosses in the ground layer were also visually estimated. Because of overlap, these components added to more than 100 percent. Cover data were summarized by calculating mean values for each species and each component. Relative cover (percent of total cover) and frequency values were also determined.

9.2.4.2 Production

Production data were collected using a harvest method. Individual 1.0m² quadrats were randomly located throughout each of the reference areas (Figure 9-1). Random locations were determined using pairs or random coordinates in the same manner used for locating cover quadrats. In each of the clipped quadrats, grasses and semi-shrubs were fractionated on the basis of species; forbs were separated into annuals and perennials. Shrubs were not clipped, except for low-growing species such as Oregon grape (Mahonia repens) and mountain lover (Pachystima myrsinites). Clipped samples were oven-dried for 24 hours at 100°C and were weighed to the nearest milligram. Data were summarized by obtaining mean production values for each species or species group.

9.2.4.3 Tree and Shrub Density

Density data for trees and shrubs were obtained using a line-strip transect approach. Randomly located transects 15m by 3m were

MINING AND RECLAMATION PLAN
HUNTINGTON CANYON NO. 4 MINE

9.2.4.3 Tree and Shrub Density (Continued)

used to obtain shrub density data, and transects 15m by 7m were used to obtain tree density data (Figure 9-1). Cover data for the shrub layer and for the tree canopy were obtained using a line intercept approach along the 15m line defining the centerline of each line-strip transect.

Within each of the shrub line-strip transects, individual shrubs were tallied on the basis of height class in order to obtain some measure of community structure. For individuals with multiple stems, separate counts were made for the member of individuals per transect as well as the number of stems per individual. Total density was calculated both on the basis of the number of individuals per hectare as well as the number of stems per hectare.

In each of the tree transects, the diameter at breast height was measured for each tree trunk. Trees with multiple trunks were tallied separated so that both trees per hectare and trunks per hectare values could be calculated.

Sample Adequacy

Sample adequacy was evaluated using the following formula:

$$n_{ade} = \frac{t^2 s^2}{d^2 x^2}$$

where

n_{ade} = adequate number of samples

t = t value (t-distribution) for a given level of confidence and n-1 degrees of freedom where n = actual sample size

s^2 = sample variance estimate

MINING AND RECLAMATION PLAN
HUNTINGTON CANYON NO. 4 MINE

9.2.4.3 Tree and Shrub Density (Continued)

d = the level of accuracy desired for the estimate of the mean, for grassland d = 0.1, for shrublands d = 0.2

x = sample mean

9.3 Existing Vegetative Resources

9.3.1 General Site Description

The mine lease area is in a region of deeply dissected sedimentary rocks. The elevation ranges from approximately 7,200 feet to 9,580 feet.

Temperature is quite variable due to the wide range of exposures and elevations present. The mean annual temperatures in the area ranges between 33° to 44° Fahrenheit. The frost-free period ranges from 40 to 100 days each year. Freezing is most common from November through March.

Precipitation varies with elevation and ranges from approximately 15 to 20 inches, with 60 to 70 percent as snow during the months of October through May.

Vegetationally, the Huntington Canyon Mine No. 4 is located within the Pinyon-Juniper Vegetation Zone as described by Cronquist, et al (1972). This forest type occupies extensive areas in the Intermountain Region. Where the valleys are low in elevation these woodlands are restricted to the slopes of mountains. However, they form a continuous expanse from mountain to mountain in eastern Nevada, the Uinta Basin, and the Canyon Lands of eastern Utah where the elevation is higher.

MINING AND RECLAMATION PLAN
HUNTINGTON CANYON NO. 4 MINE

9.3.1 General Site Description (Continued)

The pinyon-juniper zone is characterized by low evergreen trees which rarely exceed 20 feet in height and are usually spaced so their branches do not touch. The understory is a combination of shrubs and herbaceous plants, often with nearly bare ground. Dominant species vary with elevation and geography. The predominant species are pinyon pine (Pinus edulis), Utah juniper (Juniperus osteosperma) and western juniper (Juniperus occidentalis).

9.3.2 Vegetation Types

The Huntington Canyon Lease Area is composed of seven community types (See Table 9-1). Some of the factors that influence the distribution of these communities on the lease area are elevation, slope, aspect, soil and drainage patterns.

A sagebrush - grassland community occurs on the higher elevated areas. This community occupies the driest sites. The proportions of sagebrush to grasses varies considerably from site to site. The dominant species are sagebrush (Artemisia tridentata) and Salina wildrye (Elymus salinus).

The sagebrush - grassland community intergrades with both the Douglas-fir and oak shrubland. The Douglas-fir community occurs at the higher elevations, and in the drainage areas. This community is uncommon on south slopes, but dominates a number of northern slopes in the area. Aspen stands occurs interspersed throughout the Douglas-fir community.

MINING AND RECLAMATION PLAN
HUNTINGTON CANYON NO. 4 MINE

TABLE 9-1
AREAL EXTENT OF VEGETATION ON
HUNTINGTON CANYON MINE NO. 4 LEASE AREA
EMERY COUNTY, UTAH

Vegetation Type	Lease Area (Acres)	Affected Area (Acres)	Lease Area Percentages
Pinyon-Juniper Woodland	637.7	87.7	48.3
Douglas-fir Forest	146.0	-	11.3
Oak Shrubland	114.6	-	8.7
Sagebrush-Grassland	63.9	-	4.8
Burned Area	353.9	-	26.8
Riparian	4.0	-	0.1
Wetlands	<u>1.0</u>	<u>-</u>	<u>0.1</u>
TOTAL	1320.1	87.7	100.0

*Acreage and percentage dates may be modified after field proofing of the vegetation map during the spring of 1982.

MINING AND RECLAMATION PLAN
HUNTINGTON CANYON NO. 4 MINE

9.3.2 Vegetation Types (Continued)

The oak shrubland occurs interspersed with the sagebrush-grassland community in numerous areas. The oak shrubland apparently occurs in moister sites than the sagebrush-grassland community. The dominant species is oak (Quercus gambelii), which ranges from 1-5m in height. It forms tight dense thickets in some areas.

The wetland communities on the lease area are small in size and area. These areas consist of small seeps located above the mine portal outside the disturbed area. These seeps are discussed in the section on Surface Water Hydrology.

Four seeps were found within the pinyon-juniper woodland on the lease area. Seep 1 is approximately 100 m long and 1-2 m wide. The ground cover occurring along the seep consisted of dense stands of sedge (Carex sp.), willowweed (Epilobium halleanum), and false solomonseal (Smilacina racemosa). Seeps 2 and 3 were approximately 25 m long and 1-3 m wide. The ground cover was composed of sedge, spikerush, and rush. Seep 4 is under an overhang and is not vegetated.

A riparian community occurs along Huntington and Mill Fork Creeks. Huntington Creek just cuts through the northeast corner of the lease area. Mill Fork Creek occurs just off the lease area. The community consists of Douglas-fir, narrowleaf cottonwood (Populus angustifolia), chokecherry (Prunus virginiana), and scattered Englemann spruce (Picea engelmannii). Shrubs present include willow (Salix sp.) and red osier dogwood (Cornus stolonifera).

MINING AND RECLAMATION PLAN
HUNTINGTON CANYON NO. 4 MINE

9.3.2 Vegetation Types (Continued)

A burn area comprises 26.8% of the lease area. A fire occurred during 5-8 July 1964. The area is within the Little Bear Canyon drainage. Part of the land occurs on the Manti-LaSal National Forest.

The community composition before the fire consisted of dense stands of Douglas-fir and subalpine fir (Abies lasiocarpa) with a seedling-sapling stand of approximately 150 stems per acre. Very little herbaceous vegetation was present. A thick litter layer covered the forest floor.

After the fire, the area was aerial seeded by helicopter. The seed mix consisted of brome (Bromus sp.), slender wheatgrass (Agropyron trachycaulum), stiffhair wheatgrass (Agropyron trichophorum), tall grass (Arrhenatherum elatius), orchard grass (Dactylis glomerata), timothy (Phleum pratense), alfalfa (Medicago sativa), and sweet clover (Melilotus sp.). Inspection of the burned area revealed that the seeding job was spotty.

A proposal to hand plant the area back to Douglas-fir was determined not to be feasible because of steep slopes, aspect, and shallowness of the soil. The area today consists of standing and fallen conifer and aspen poles. The area could be considered a shrub-grassland. Shrubs invading the area consist of Gambel oak, big tooth maple, aspen, gooseberry (Ribes sp.), and snowberry (Symphoricarpos sp.). Besides the combinations of the seeded grasses mentioned above, Salina wildrye and nodding brome (Bromus anomalus) also occur.

MINING AND RECLAMATION PLAN
HUNTINGTON CANYON NO. 4 MINE

9.3.2 Vegetation Types (Continued)

The pinyon-juniper community commonly occurs on the dry southern slopes below 9,000 feet and somewhat higher in some areas. The dominant species are pinyon pine (Pinus edulis) and Utah juniper (Juniperus osteosperma). The most common shrubs are mountain mahogany and pinyon pine. The dominant grass in the community is Salina wildrye. The mine portal, associated facilities, and disturbed areas are located entirely in this community.

9.3.2.1 Cover Data

All of the surface area which has been disturbed is within the pinyon-juniper vegetation type, therefore the reference area cover data was taken only for this type.

Three species reach tree status in this stand (Table 9-2). The canopy vegetation is dominated by pinyon pine with a mean canopy cover of 3.0%. Utah juniper is the second most important species with a canopy cover of 0.6%. The number of trees per ha is 230 with a total basal area of 13.01 m²/ha.

Four species of shrubs make up the shrub layer (Table 9-3). Curl-leaf mountain mahogany and pinyon pine are the most common shrubs having % frequency of 32.5 and 25.0, respectively. There are 239 shrubs/ha having a total cover of 40.0+ m²/ha.

MINING AND RECLAMATION PLAN
HUNTINGTON CANYON NO. 4 MINE

TABLE 9-2. PINYON-JUNIPER WOODLAND. Reference Area. Cover, frequency, density, and basal area summaries for tree layer species. Based on data from 40 7m x 15m line-strip transects. 1981 data.

Species	No. of Trees	Frequency (%)	Mean Canopy Cover	Density Individuals per hectare	No. of Stems per hectare	Mean Stem Diameters + S.D. (cm)	Mean Basal Area per Stem + S.D. (cm ²)	Basal Area per hectare (m ²)
<u>Cercocarpus ledifolius</u>	30	45.0	0.5	71	107	11.01 + 4.86	113.36 + 94.54	1.21
<u>Juniperus osteosperma</u>	17	37.5	0.6	40	57	21.27 + 8.75	412.80 + 303.61	2.36
<u>Pinus</u> <u>resinosa</u>	50	70.0	3.0	119	140	26.06 + 13.39	617.70 + 652.44	9.44
TOTAL			4.1	230	304			13.01

MINING AND RECLAMATION PLAN
HUNTINGTON CANYON NO. 4 MINE

Table 9-3. PINYON-JUNIPER WOODLAND. Reference Area. Cover, frequency, and density summaries for shrub species. Based on data from 40 3m x 15m line-strip transects. 1981 data.

Species	Height Class*	Mean Cover (%)	Relative Cover (%)	Frequency (%)	Density (no. ind. per hectare)		Density (no. stems per hectare)	
					By Height Class	Total \pm S.D.	By Height Class	Total \pm S.D.
<u>Cercocarpus ledifolius</u>	Total	0.2	50.00	32.5		89 \pm 158		106 \pm 220
	I				28		28	
	II				17		17	
	III				22		22	
	IV				22		39	
<u>Chrysothamnus viscidiflorus</u>	Total	0.1	0.01	2.5		6 \pm 36		6 \pm 36
	I				6		6	
<u>Juniperus osteosperma</u>	Total	0.1	25.00	17.5		72 \pm 204		72 \pm 204
	I				33		33	
	II				22		22	
	III				17		17	
<u>Pinus edulis</u>	Total	0.1	25.00	25.0		72 \pm 138		72 \pm 138
	I				22		22	
	II				22		22	
	III				11		11	
	IV				17		17	
TOTAL		0.4+%				239 \pm 300		256 \pm 329

*Height Class I = 0.25 m - 0.75m, Class II = 0.76m - 1.50m, Class III = 1.51m - 2.25m, Class IV = 2.25m - 3.00m

MINING AND RECLAMATION PLAN
HUNTINGTON CANYON NO. 4 MINE

9.3.2.1 Cover Data (Continued)

The herbaceous ground cover consisted of 4 graminoid, 2 shrub, and 6 forb species (Table 9-4). Seedlings of both pinyon pine and curl-leaf mountain mahogany were noted. The total percent vegetative ground cover including lichens and mosses was approximately 12.2%. Approximately 95.9% of this cover consisted of graminoids. Salina wildrye dominates the layer, making up 88.9% of the total herbaceous cover. The non-vegetative ground cover consisted of 15.8% rock and 66.9% litter.

9.3.2.2 Production Data

The total average dry weight production for 40 1m² quadrats in reference area was 30.8 g/m². (Table 9-5). Salina wildrye makes up approximately 98.1% of the production in the ground layer.

9.3.2.3 Sample Adequacy

Sample adequacy was attained for vegetation cover, for shrub density, and for tree density (Table 9-6). Based on the sample adequacy equation, an additional 29 production samples would be required to obtain adequacy, however the maximum number of 40 samples required by the Utah DOGM was obtained.

9.3.2.4 Species List

The plant list resulting from the survey is presented in Table 9-7. The table is arranged in alphabetical order by plant family. Species are identified in the table according to common name, scientific name, growth form, and

MINING AND RECLAMATION PLAN
 HUNTINGTON CANYON NO. 4 MINE

TABLE 9-4 (Continued) PINYON-JUNIPER WOODLAND. Reference area.

	Mean Cover (%)	Range of Cover Values
Sum of Species Cover	12.5	4- 33
Total Woody Cover	0.7	0- 25
Total Herbaceous Cover	6.0	5- 21
Lichens	1.0	0- 9
Mosses	0.1	0- 3
Litter	66.9	12-100
Rock	15.8	0- 78
Bare Soil	17.2	0- 36
<p>Evaluation of the herb layer and ground layer as a single unit. The values in this section add to 100 percent for each quadrat.</p>		
Total Vegetation	12.2	4- 25
Litter/Rock	70.6	51- 91
Bare Soil	17.2	0- 36
<u>Number of Species per Square Meter</u>	<u>Mean + S.D.**</u>	<u>Range</u>
Herb Species	1.88 + 0.97	1-5
Woody Species	0.10 + 0.30	0-1
Total Species	1.98 + 1.07	1-5

* Importance Value (I.V.) = Relative Cover + Relative Frequency

** + values equal the standard deviation (S.D.)

MINING AND RECLAMATION PLAN
 HUNTINGTON CANYON NO. 4 MINE

TABLE 9-4. PINYON-JUNIPER WOODLAND. Reference Area. Cover, frequency, and species diversity summaries for herb layer components. Based on data from 40 1m quadrats. 1981 data.

	Mean Cover (%)	Relative Cover (%)	Range of Cover Values	Percent Frequency	Relative Frequency (%)	I.V.*	Rank
<u>PERENNIAL GRASSES AND SEDGES</u>							
<u>Agropyron trachycaulum</u>	0.3	2.38	0- 5	7.5	3.80	6.18	6
<u>Carex rossii</u>	0.2	1.59	0- 2	20.0	10.13	11.72	3
<u>Elymus salinus</u>	11.2	88.89	4- 19	100.0	50.63	139.52	1
<u>Oryzopsis hymenoides</u>	0.1	0.01	0 - 1	2.5	1.27	1.27	7
Sub-Total	11.7	92.86					
<u>FORBS</u>							
<u>Agalus diversifolius</u>	0.1	0.01	0- 1	2.5	1.27	1.27	7
<u>Cryptantha humilis</u>	0.2	1.59	0- 1	32.5	16.46	18.05	2
<u>Phlox longifolia</u>	0.1	0.01	0- 1	2.5	1.27	1.27	7
<u>Salsola kali</u>	0.1	0.01	0- 1	2.5	1.27	1.27	7
<u>Senecio sp.</u>	0.1	0.01	0- 1	2.5	1.27	1.27	7
<u>Sisymbrium linifolium</u>	0.1	0.01	0- 1	15.0	7.59	7.59	5
Sub-Total	0.2	1.59					
<u>SHRUBS</u>							
<u>Cercocarpus ledifolius</u>	0.7	5.56	0- 25	7.5	3.80	9.36	4
<u>Pinus edulis</u>	0.1	0.01	0- 1	2.5	1.27	1.27	7
Sub-Total	0.7	5.56					

MINING AND RECLAMATION PLAN
 HUNTINGTON CANYON NO. 4 MINE

TABLE 9-5. PINYON-JUNIPER WOODLAND. Reference area. Mean production \pm the standard deviation (S.D.). Based on data from 40 1m² quadrats. 1981 data.

Species	Mean \pm S.D. (grams/m ²)	Mean \pm S.D. (lbs/acre)	Percent of Total Biomass
<u>PERENNIAL GRASSES AND SEDGES</u>			
<u>Agropyron trachycaulum</u>	0.11 \pm 0.072	1 \pm 1	0.04
<u>Carex sp.</u>	0.394 \pm 1.155	4 \pm 10	1.28
<u>Elymus salinus</u>	30.218 \pm 19.842	270 \pm 177	98.05
<u>Poa sp.</u>	0.018 \pm 0.111	1 \pm 1	0.06
Sub-Total	30.641 \pm 19.529	274 \pm 174	
<u>ANNUAL FORBS</u>	0.002 \pm 0.007	1 \pm 1	0.01
<u>PERENNIAL FORBS</u>	0.175 \pm 0.310	2 \pm 3	0.57
<u>TOTAL PRODUCTION</u>	30.818 \pm 19.538	275 \pm 174	

MINING AND RECLAMATION PLAN
HUNTINGTON CANYON NO. 4 MINE

TABLE 9-6. Evaluation of sample adequacy for the Pinyon-Juniper Woodland reference area sampled at the Huntington Canyon No. 4 Mine.

	Sample Size (n)	Mean + Standard Deviation	Degrees of Freedom (n-1)		Value of t (one-tailed)	Computed Adequate Sample Size (nade)
<u>VEGETATION COVER</u>	40	12.18 ± 4.63	39	0.1	1.304	25
<u>HERBACEOUS LAYER PRODUCTION (grams/m²)</u>	40	30.818 ± 19.538	39	0.1	1.304	68
<u>DENSITY (No. Ind./Plot)</u>						
Shrubs						
Stems	40	1.15 ± 1.48	39	0.2	0.851	30
Individuals	40	1.08 ± 1.35	39	0.2	0.851	29
Trees						
Stems	40	3.20 ± 2.34	39	0.2	0.851	10
Individuals	40	2.43 ± 1.50	39	0.2	0.851	7

MINING AND RECLAMATION PLAN
HUNTINGTON CANYON NO. 4 MINE

TABLE 9-7
PLANT SPECIES OBSERVED ON
HUNTINGTON CANYON MINE NO. 4 LEASE AREA
EMERY COUNTY, UTAH, 1980

Common Name	Family/Scientific Name	Growth Form	Pinyon-Juniper Woodland	Sagebrush-Grassland	Oak Shrubland	Douglas Fir	Wetland Riparian
MAPLE FAMILY Bigtooth maple	ACERACEAE <u>Acer grandidentatum</u>	Tree			X		
BARBERRY FAMILY Oregon grape	BERBERIDACEAE <u>Mahonia repens</u>	Shrub	X	X	X	X	
BORAGE FAMILY Catseye	BORAGINACEAE <u>Crypthantha abata</u>	Forb	X				
Houndstongue	<u>Cynoglossum officinale</u>	Forb	X	X	X	X	
Stickseed	<u>Lappula occidentalis</u>	Forb	X	X	X	X	
Puccoon	<u>Lithospermum sp.</u>	Forb	X				
CACTUS FAMILY Aggregate cactus	CACTACEAE <u>Echinocereus triglochidiatus</u> var. <u>melanacanthus</u>	Shrub	X	X			
HONEYSUCKLE FAMILY Elderberry	CAPRIFOLIACEAE <u>Sambucus coerulea</u>	Shrub	X			X	
Snowberry	<u>Symphoricarpos vaccinoides</u>	Shrub			X	X	
GOOSEFOOT FAMILY Halogeton	CHENOPODIACEAE <u>Halogeton glomeratus</u>	Forb	X				
Summer cypress	<u>Kochia scoparia</u>	Forb	X				
Russian thistle	<u>Salsola kali</u>	Forb	X				

MINING AND RECLAMATION PLAN
HUNTINGTON CANYON NO. 4 MINE

TABLE 9-7 (CONTINUED)
PLANT SPECIES OBSERVED ON
HUNTINGTON CANYON MINE NO. 4 LEASE AREA
EMERY COUNTY, UTAH, 1980

Common Name	Family/Scientific Name	Growth Form	Pinyon-Juniper Woodland	Sagebrush-Grassland	Oak Shrubland	Douglas Fir	Wetland Riparian
SUNFLOWER FAMILY ASTERACEAE							
Yarrow	<u>Achillea millefolium</u>	Forb		X	X	X	
Big sagebrush	<u>Artemisia tridentata</u>	Shrub		X			
Rabbitbrush	<u>Chrysothamnus nauseosus</u> var. <u>albicaulis</u>	Shrub		X	X		
Rabbitbrush	<u>Chrysothamnus viscidiflorus</u>	Shrub		X	X		
Thistle	<u>Cirsium undulatum</u>	Forb	X	X	X		
Snakeweed	<u>Gutierrezia sarothrae</u>	Shrub	X	X	X		
	<u>Machaeranthera grindelioides</u>	Forb	X				
	<u>Machaeranthera sp.</u>	Forb	X	X			
DOGWOOD FAMILY CORNACEAE							
Red osier dogwood	<u>Cornus stolonifera</u>	Shrub					X
CYPRESS FAMILY CUPRESSACEAE							
Mountain common juniper	<u>Juniperus communis</u>	Shrub	X			X	
Utah Juniper	<u>Juniperus osteosperma</u>	Tree	X				
Rocky Mountain juniper	<u>Juniperus scopulorum</u>	Tree	X		X	X	
SEDE FAMILY CYPERACEAE							
Sedge	<u>Carex sp.</u>	Graminoid					X
Spikerush	<u>Eleocharis sp.</u>	Graminoid					X
HEATH FAMILY ERICACEAE							
Greenleaf manzanita	<u>Arctostaphylos patula</u>	Shrub			X		
BEECH FAMILY FAGACEAE							
Gambel oak	<u>Quercus gambelii</u>	Tree			X		

MINING AND RECLAMATION PLAN
HUNTINGTON CANYON NO. 4 MINE

TABLE 9-7 (CONTINUED)

PLANT SPECIES OBSERVED ON
HUNTINGTON CANYON MINE NO. 4 LEASE AREA
EMERY COUNTY, UTAH, 1980

Common Name	Family/Scientific Name	Growth Form	Pinyon-Juniper Woodland	Sagebrush-Grassland	Oak Shrubland	Douglas Fir	Wetland Riparian
GRASS FAMILY		POACEAE					
Crested wheatgrass	<u>Agropyron cristatum</u>	Graminoid	X	X			
Tall wheatgrass	<u>Agropyron elongatum</u>	Graminoid	X	X			
Bluebunch wheatgrass	<u>Agropyron spicatum</u>	Graminoid	X				
Slender wheatgrass	<u>Agropyron trachycaulum</u>	Graminoid	X	X			
Redtop	<u>Agrostis stolonifera</u>	Graminoid					X
Nodding brome	<u>Bromus anomalus</u>	Graminoid	X				
Reedgrass	<u>Calamogrostis scopulorum</u>	Graminoid	X			X	
Salina wildrye	<u>Elymus salinus</u>	Graminoid	X	X	X		
Wildrye	<u>Elymus simplex</u>	Graminoid	X				
Meadow barley	<u>Hordeum brachyantherum</u>	Graminoid		X			X
Junegrass	<u>Koeleria nitida</u>	Graminoid	X				
Foxtail muhly	<u>Muhlenbergia andina</u>	Graminoid					X
Indian ricegrass	<u>Oryzopsis hymenoides</u>	Graminoid	X				
Timothy	<u>Phleum pratense</u>	Graminoid	X				
Leiberg bluegrass	<u>Poa leibergii</u>	Graminoid	X				
Nodding bluegrass	<u>Poa reflexa</u>	Graminoid	X				
RUSH FAMILY		JUNCACEAE					
Rush	<u>Juncus ensifolius</u>	Graminoid					X
PEA FAMILY		FABACEAE					
Milkvetch	<u>Astragalus sp.</u>	Forb	X	X			
Silky lupine	<u>Lupinus sericeus</u>	Forb		X			
Alfalfa	<u>Medicago sativa</u>	Forb		X	X		

TABLE 9-7 (CONTINUED)
PLANT SPECIES OBSERVED ON
HUNTINGTON CANYON MINE NO. 4 LEASE AREA
EMERY COUNTY, UTAH, 1980

Common Name	Family/Scientific Name	Growth Form	Pinyon-Juniper Woodland	Sagebrush-Grassland	Oak Shrubland	Douglas Fir	Wetland Riparian
LILY FAMILY	LILIACEAE						
Mariposa lily	<u>Calochortus</u> sp.	Forb		X			
False Solomonsseal	<u>Smilacina racemosa</u>	Forb					X
EVENING PRIMROSE FAMILY	ONAGRACEAE						
Willoweed	<u>Epilobium halleanum</u>	Forb					X
PINE FAMILY	PINACEAE						
Subalpine fir	<u>Abies lasiocarpa</u>	Tree				X	
Englemann spruce	<u>Picea engelmannii</u>	Tree				X	
Pinyon pine	<u>Pinus edulis</u>	Tree	X				
Intermountain bristlecone pine	<u>Pinus longaeva</u>	Tree					
Ponderosa pine	<u>Pinus ponderosa</u>	Tree	X			X	
Douglas fir	<u>Pseudotsuga menziesii</u>	Tree	X			X	
BUTTERCUP FAMILY	RANUNCULACEAE						
Virgin's bower	<u>Clematis pseudoalpina</u>	Forb				X	
Columbine	<u>Aquilegia</u> sp.	Forb	X				
ROSE FAMILY	ROSACEAE						
Curly-leaf mountain mahogany	<u>Cercocarpus ledifolius</u>	Shrub	X				
Alder-leaf mountain mahogany	<u>Cercocarpus montanus</u>	Shrub	X				
Ninebark	<u>Physocarpus capitatus</u>	Shrub	X				
Chokecherry	<u>Prunus virginiana</u>	Tree					
Bitterbrush	<u>Purshia tridentata</u>	Shrub	X		X		X

TABLE 9-7 (CONTINUED)

PLANT SPECIES OBSERVED ON
HUNTINGTON CANYON MINE NO. 4 LEASE AREA
EMERY COUNTY, UTAH, 1980

Common Name	Family/Scientific Name	Growth Form	Pinyon-Juniper Woodland	Sagebrush-Grassland	Oak Shrubland	Douglas Fir	Wetland Riparian
WILLOW FAMILY SALICACEAE							
Narrow leaf cottonwood	<u>Populus angustifolia</u>	Tree					X
Aspen	<u>Populus tremuloides</u>	Tree				X	
Willow	<u>Salix sp.</u>	Shrub					X
SAXIFRAGE FAMILY SAXIFRAGACEAE							
Gooseberry	<u>Ribes cereum</u> <u>Ribes sp.</u>	Shrub	X		X	X	
FIGWORT FAMILY SCROPHULARIACEAE							
Indian paintbrush	<u>Castilleja sp.</u>	Forb		X			
Beardstongue	<u>Penstemon sp.</u>	Forb		X	X		
CARROT FAMILY APIACEAE							
Chimaya	<u>Cymopterus fendleri</u>	Forb	X				

MINING AND RECLAMATION PLAN
HUNTINGTON CANYON NO. 4 MINE

9.3.2.4 Species List (Continued)

occurrence by plant community. Species identification was from Cronquist et al (1972, 1977), Welsh and Moore (1973), McDouglas (1973), and Weber (1976).

The list includes 71 species, 58 genera, and 24 families of vascular plants. The families with the most numerous species in the list are the grass family (16) and the sunflower family (7). The flora of the lease area consists of 31.0% forbs, 23.9% shrubs, 26.8% graminoids, and 18.3% tree species.

9.3.2.5 Mine Plan Area Acreage, Acreage by Vegetation Types and Acreage of Types Affected

There are approximately 1,320 acres within the lease area. A list of approximate acres of each vegetation type as planimetered was given earlier in Table 9-1.

The 78 acres of disturbed land was all previously covered by a pinyon-juniper type of vegetation.

9.3.2.6 Reference Area Supporting Data

The reference area is located in an area above the mine portal (Plate 9-1). The majority of this area has been mapped as part of the Patmos-Podo soil association with a portion in the northwest section mapped as Rockland. These same units are the predominant remaining undisturbed units mapped within the disturbed area. The slopes, topography and aspect of the reference area are very similar to those on the disturbed area. Vegetation is also very similar, with both areas mapped as being within the pinyon-juniper vegetation type.

MINING AND RECLAMATION PLAN
HUNTINGTON CANYON NO. 4 MINE

9.4 Threatened and Endangered Plant Species

Currently, eight species are listed as endangered or threatened in Utah. None of these threatened or endangered species, as defined and identified by the U.S. Department of Interior, Fish and Wildlife Service (USDI, 1980), were observed at Huntington Canyon No. 4 Mine. Sclerocactus wrightiae, is known to occur in Emery County. This species occurs on the Emery Sandstone Member of the Mancos Shale Formation at elevations of 3000 to 5000 feet (USDI, 1979). This formation and range of elevations do not occur on the Huntington Canyon No. 4 Mine.

No species are currently proposed as endangered or threatened in Utah (USDI, 1980). One hundred and sixty-nine plant taxa are currently considered candidate species (USDI, 1980). At some future date, some of these species may be proposed for endangered or threatened status. Of these species, five are known to occur in Emery County. The San Rafael milkvetch (Astragalus rafaensis) occurs in central Emery County in salt desert shrub and scattered juniper communities at elevations of 4500 to 5300 feet. The Johnston catseye (Cryptantha johnstonii) also occurs in central Emery County on the Carmel Formation at elevations of 5200 to 6000 feet. Jones catseye (Cryptantha jonesiana) occurs in central Emery County on the Sinbad Member of the Moenkopi Formation in pinyon-juniper and mixed desert shrub communities at 5200 to 6200 feet in elevation. Smith buckwheat (Eriogonum smithii) occurs in southern Emery County in the desert shrub community at an elevation of 4500 to 5500 feet. Yellow blanket flower (Gaillardia flava) occurs in eastern Emery County on the Mancos Shale Formation along alluvial fans and river terraces. It occurs in Salix-Populus communities at elevations of 4200 to 5400 feet. These elevations, geologic formations, and/or vegetational communities do not occur on the Huntington Canyon Mine No. 4 lease area.

MINING AND RECLAMATION PLAN
HUNTINGTON CANYON NO. 4 MINE

9.5 Effects of Mining Operations on Vegetation

All anticipated surface disturbance and effects on vegetation have already taken place.

A total of 78 acres of pinyon-juniper vegetation has been removed as a result of mining, an additional 9.2 acres was disturbed prior to mining by the construction of a National Forest Service Road through the area of the lease which has also been disturbed by mining.

9.6 Mitigation and Management Plans

As noted previously the Huntington Canyon No. 4 Mine is an existing operation. Therefore, mitigation and management measures have been designed to prevent additional impacts related to continued mining activities and to facilitate rapid return of the site to productive use after decommissioning.

The relatively small-scale disturbance associated with the mining operation will be mitigated upon completion of the project by reclaiming the disturbed sites with an approved seed mix. The plant mix was selected to offer a diverse assemblage of herbaceous and woody species that are adapted to onsite conditions and are of known value for cover, forage, or both. The comprehensive reclamation procedure is fully described in Section 3.5, Reclamation Plan.

Disturbance of the riparian vegetation along Mill Fork Canyon is being controlled by maintaining (1) a buffer strip adjacent to the stream and (2) a diversion system to keep mine runoff away from the stream.

MINING AND RECLAMATION PLAN
HUNTINGTON CANYON NO. 4 MINE

9.6 Mitigation and Management Plans (Continued)

No grazing will be allowed on reseeded areas for at least two growing seasons after planting.

9.7 Revegetation Methods

Seeding and planting of disturbed areas shall be conducted during the first normal period for favorable planting conditions after final preparation. When necessary to effectively control erosion, any disturbed area shall be seeded, as contemporaneously as practicable, with a temporary cover of small grains, grasses, or legumes until a permanent cover is established.

The disturbed areas will be regraded to rather steep slopes which will exclude most methods of machine planting. Therefore areas to be planted will be "roughened" by raking (or other means) to help hold the seeds in place. The proper seed mixture will then be spread either by hand or machine. Mulch will be applied as necessary, either by machine or by hand in inaccessible areas. The revegetated area will be monitored and if success appears unlikely, alterations will be made with concurrence of the landowners until revegetation success is to their satisfaction.

MINING AND RECLAMATION PLAN
HUNTINGTON CANYON NO. 4 MINE

9.8 Revegetation Monitoring

Revegetation monitoring will consist of visual inspections of the revegetated area for the first few years after seeding. If the vegetation on certain areas does not appear to be reestablishing an acceptable cover, additional soil tests will be taken, and, if nutrients or soil additives are found to be deficient needed amendments will be added and the area replanted.

Any areas showing excessive erosion will also be repaired with additional topsoil and/or regraded and replanted.

Vegetative monitoring for bond release will follow the same procedures as those utilized during the baseline vegetation survey described in detail under Section 9.2. These methods include utilization of random quadrats to determine ground cover, line-strip transects to sample tree and shrub density, and randomly located 1m² quadrats to measure productivity.

MINING AND RECLAMATION PLAN
HUNTINGTON CANYON NO. 4 MINE

9.9 Bibliography

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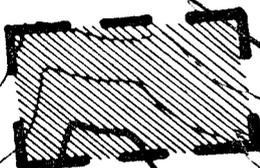
B0

16

300

P-J

Pinyon-Juniper Woodland
Reference Area
est. 1981



200m

50m

Canyon

7600

P-J