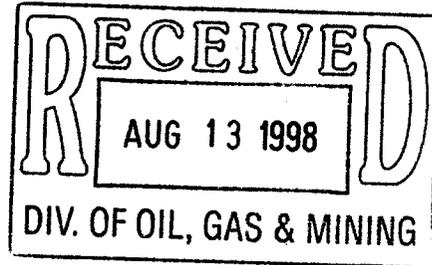


0004

August 11, 1998



Mr. Bob Davidson
DOGM, State of Utah
1594 West North Temple, Suite 1210
Box 145801
Salt Lake City, Utah 84114-5801

RE: **Vegetation Monitoring Survey - J.B. King Mine, ACT/015/002-97B, File#2,**
Emery County, Utah

Dear Bob:

Bob
Susan

Please find attached a *1998 Vegetation Monitoring Survey* prepared by Bamberg Associates for the J.B. King reclaimed coal mine in Emery County, Utah. It is Western States Minerals Corps. intent to seek Phase II bond release for the J.B. King project during 1998 and this completes the first part of the associated requirements for that release. Please note that Bamberg Associates' survey shows that the J.B. King site exceeds the reference area for vegetative/plant cover; and therefore qualifies for bond release, based on the vegetative cover criteria.

Concerning the criteria for erosional stability; we would like to have some feedback on what data you might require to satisfy this facet of the regulation. We are prepared to meet with you and your associates in the field to address any concerns or questions that you might have. Please let me know at your earliest convenience when we can discuss your requirements for erosional stability, so that we can conclude the remaining criteria for Phase II bond release as soon as possible.

Sincerely,

E.M. (Buzz) Gerick
Vice President of Operations

CC: Al Cerny, WSMC- Wheat Ridge

**PLANT SURVEYS AT THE RECLAIMED
J.B. KING MINE, EMERY COUNTY, UTAH**

**MONITORING DURING 1998
FOR VEGETATION COMPOSITION AND COMPLIANCE WITH
RECLAMATION STANDARDS - PHASE II BOND RELEASE**

Submitted to
WESTERN STATES MINERALS CORPORATION
205 S. Rock Blvd., Suite 130
Reno, Nevada 89502

Prepared by
Bamberg Associates
26050 E. Jamison Circle
Aurora, Colorado 80016

July 1998

TABLE OF CONTENTS

1.0	INTRODUCTION	1
2.0	METHODS	1
2.1	General Methodology	2
2.2	Sample Adequacy	3
3.0	RESULTS	3
3.1	Plant Cover	4
3.2	Shrub Density	4
3.3	Sample Adequacy	7
4.0	DISCUSSION	8
4.1	Plant Cover and Shrub Density	8
4.2	Visual Survey	9
5.0	Conclusion	10
	REFERENCES	11

LIST OF TABLES

Table 3-1.	Plant Species List for J.B. King Mine, June 1998.....	5
Table 3-2.	Average Percent Plant Cover at the J.B. King site, June 1998.....	6
Table 3-3.	Shrub Density at J.B. King Mine, June 1998.....	7

FIGURES (follow page 11)

Figure 3-1. Reclaimed J.B. King Site showing vegetation type, topography, and drainage channels. June 25, 1998.

Figure 3-2. Reference area showing vegetation type and grid layout. June 27, 1998.

Figure 3-3. View of the J.B. King site looking down drainage toward the northwest along long axis of the valley. June 25, 1998.

Figure 3-4. View of the J.B. King site looking southeast up the valley; note sediment pond in left foreground. June 25, 1998.

Figure 4-1. View of the drainage channels reconstructed in 1994; reseeded area in left center of photograph. June 25, 1998.

Figure 4-2. View of refuse area plated with rock and reseeded in 1994. June 25, 1998.

1.0 INTRODUCTION

Bamberg Associates conducted a monitoring survey of the plant cover and shrub density on the reclaimed portion of the J. B. King Mine site and its associated reference area for Western State Minerals. Our survey will help establish if the site meets the vegetative criteria required by the Utah Division of Oil, Gas, and Mining (The Division) for a Phase II Bond release. For the first ten years of the bonding period, monitoring has been conducted on the site every two years as required by the Division (Boucek 1987, Bamberg and Bamberg 1989, Bamberg and Hanne 1991, 1992a, 1993a, 1994). This current monitoring in 1998 is for an extended bond period after additional reclamation in December 1994 (Hansen, Allen, & Luce, 1994).

The J.B. King Coal Mine is located approximately 10 linear miles south of Emery, Utah in Emery County; Range 6 East, Township 23 South, Section 32, SLBM. Western States Minerals Company owns this mine and requested this monitoring survey to comply with a Phase II Bond Release. The mine was initially reclaimed in 1984-5 based on previous studies (Native Plants, 1983) for plant species seeded and methods. A portion of the mine was reclaimed in 1994 using newer methods (Bamberg and Hanne, 1993b, Hansen, Allen, & Luce 1994).

We monitored vegetative cover by species and woody plant densities, although only vegetative cover was required. Our monitoring methods followed the procedures for vegetation cover and shrub density established in the past surveys. These surveys are detailed in the baseline inventory reports (Bamberg and Bamberg 1989, Bamberg and Hanne 1991, 1992, and 1993). The present survey was performed between June 25 and 27, 1998

The results of our monitoring surveys showed that the reclaimed mine site has successful revegetation. Total desirable plant cover on the mine site averaged 18.4%. The established reference area for this mine averaged 13.1% plant cover. Sample adequacy for both the site and the reference area were determined and met. Although not required by The Division, we measured shrub density and calculated 2875 shrubs per acre on the site and 8400 shrubs per acre on the reference area. Since the site meets and even exceeds the reference area level of plant cover, we recommend that the J.B. King Mine can be released from the bond based on vegetative cover.

2.0 METHODS

We established a grid system and randomly selected plots monitored by a quadrat sampling

method. The grid system and size of the quadrat were adjusted for the vegetative conditions of the reclaimed site and the reference area. We used the same methods on the J.B. King site and the reference area. Each quadrat was analyzed for ground cover and shrub density. Sample adequacy was calculated for both the site and the reference area. We concluded our monitoring with a visual inspection of the site for over plant condition and vigor, degree of erosion, and vegetative patchiness.

The entire reclaimed site was treated as one unit including the refuse pile area contoured and seeded in 1994. The Division test plots reclaimed in 1994 on the flat area of the refuse pile were also included in the surveys.

2.1 General Methodology

We used the same methods for ground cover and shrub density monitoring as during the previous surveys according to UMC 784.13 of the approved permit. These methods consisted of locating random sampling quadrats and recording percent cover of plants by species, litter, rock, and bare ground. We also recorded percent ground covered by standing dead plant material as requested by Susan White of the Division. We included in our survey a shrub density count of the mine site and reference area and a visual inspection of the mine site.

We established a grid system on both the reclaimed section of the mine site and the reference area during the 1998 survey. This system is similar to the grids established in 1989, 1991, and 1993 sampling grids. The grids were in the form of a cross using two staked lines at ninety degrees to each other. The distance between nodes was 30 meters (98.4 feet) on the mine site and 15 meters (49.2 feet) on the smaller, more uniform reference area. Each node of the grids was numbered. The nodes used as sampling points were determined using a random number generator.

The location of each sample quadrat from each sample node was determined by tossing a pen over our shoulder. We always laid out the quadrats to the southeast. Quadrats measured 4 m² (43.03 f²) on the mine site and 1 m² (10.76 f²) on the reference area. We had determined these optimal quadrat sizes for the site and reference area during previous surveys using a nested species area curve (Bamberg and Hanne, 1992). Vegetation in the reference area is very uniform, so 20 samples were initially selected then tested for sample adequacy. On site, 40 samples were initially selected.

We visually estimated ground cover within each quadrat to the nearest whole percent cover. Within each quadrat, we determined the percent of the ground covered by each plant species. If two different species of plants overlapped as ground cover, for example grass underneath a shrub, we only recorded the uppermost canopy. The individual plant species added together for a total vegetative cover. We then estimated litter, standing dead, and rock to the nearest one percent. The remaining percent was calculated as bare ground for a total of 100 percent ground cover.

Although not required for bond release, we also determined shrub density and visually inspected the sites. Each shrub rooted within the ground cover quadrats was counted by species for shrub density. Our visual inspection consisted of surveying the site for general condition and plant growth during the monitoring surveys. During these surveys, we assessed the current state of the site and the plant species present were noted.

2.2 Sample Adequacy

To ensure that a representative average of the ground cover was recorded, an adequate number of samples must be taken. We determined this number using the following formula from Division guidelines:

$$n_{\min} = \frac{t^2 s^2}{(dx)^2}$$

where: n_{\min} = minimum number of samples necessary, based on total cover or density estimates
 x = sample mean
 s = standard deviation of the sample
 t = the t value for a 1-tailed t-test at 90% confidence (= 1.31)
 d = desired change in the mean (= 0.1)

The Division guidelines recommend a minimum of 10 samples per site be measured for both cover and density. They suggest using a 10% change in the mean with a 90% confidence interval. The Division does not recommend a maximum number of samples.

3.0 RESULTS

The results are presented for vegetative plant cover and shrub density for the reclaimed JB

King site, and compared to the reference area (see Figures 3-1 and 3-2). Observations during the visual inspection are also presented (See Figures 3-3 and 3-4).

3.1 Plant Cover

We have observed from surveys in 1991 to 1994, and to the present that the number of species at the J.B. King Mine has remained fairly constant over the past several years. A few native species continue to become established on the reclaimed site, and some species are increasing in abundance. Table 3-1 is a floristic list of all plant species recorded on the J.B. King mine site. Nomenclature follows the floristic manual by Welsh, Stanley, et al., 1987. A Utah Flora.

Plant cover results are given in Table 3-2. Total desirable plant cover on the mine site was 18.4%. On the reference area, total plant cover was 13.1%. A greater percent cover and variety of shrub species were present on the mine site as compared to the reference area. However, the reference area was covered by more and a greater variety of forbs.

On the mine site, the woody shrubs were the most abundant vegetation and covered an average of 14% of the ground. Grasses covered slightly less than 5% of the ground. Herbaceous dicots, forbs, were not abundant during our survey and comprised less than 0.1% of the ground cover. Litter and standing dead plant material each accounted for slightly more than 7% of the cover. Surface rock and rock mulch comprised an average of 24% of the ground cover. The remaining 41% of the ground was bare.

The 3 categories of vegetative cover were more evenly distributed on the reference area. Grasses, shrubs, and forbs comprised 6.3, 4.3, and 2.5% of the ground cover respectively. Litter was about 4.5% cover. Standing dead plant material covered slightly less than 4% of the ground. Although the rock surface cover was visually prominent, it consisted of numerous very small pebbles. The rock surface averaged less than 6% of the ground cover. The remaining 73% of the ground surface was bare.

3.2 Shrub Density

Table 3-3 list the average number of viable shrubs rooted within the quadrats by species and The density for each shrub species by hectare and acre for the mine site and reference area.

Table 3-1. Plant Species Floristic List for J.B. King Mine, June 1998.

SHRUBS			
<i>Artemisia arbuscula</i>	low sagebrush	<i>Ceratoides lanata</i>	Winterfat
<i>A. bigelovii</i>	bigelow sagebrush	<i>Chrysothamnus nauseosus</i>	Rubber rabbitbrush
<i>A. filifolia</i>	sand sagebrush	<i>C. greenei</i>	Green rabbitbrush
<i>A. frigida</i>	fringed sagebrush	<i>Eriogonum corymbosum</i>	Clustered buckwheat
<i>A. ludoviciana</i>	cudweed sagewort	<i>Gutierrezia sarothrae</i>	Broom snakeweed
<i>Atriplex canescens</i>	four-wing saltbush	<i>Sarcobatus vermiculatus</i>	Greasewood
<i>A. confertifolia</i>	shadscale	<i>Tamarix pentandra</i>	Tamarisk
<i>A. gardneri</i>	Gardner's saltbush	<i>Yucca harrimaniae</i>	Harriman yucca
GRASSES			
<i>Agropyron cristatum</i>	crested wheatgrass	<i>Hilaria jamesii</i>	Galleta
<i>A. smithii</i>	western wheatgrass	<i>Hordeum jubatum</i>	Foxtail barley
<i>A. spicatum</i>	bluebunch wheatgrass	<i>Oryzopsis hymenoides</i>	Indian rice grass
<i>A. trichophorum</i>	Intermediate wheatgrass	<i>Poa fendleriana</i>	Fendler's bluegrass
<i>Aristida purpurea</i>	purple threeawn	<i>P. secunda</i>	Sandberg bluegrass
<i>Bouteloua gracilis</i>	blue grama	<i>Sitanion hystrix</i>	Squirreltail
<i>Bromus japonicus</i>	Japanese brome	<i>Sporobolus cryptandrus</i>	Sand dropseed
<i>B. tectorum</i>	cheatgrass	<i>Stipa comata</i>	Needle-and-thread
FORBS			
<i>Aster chilensis</i>	Pacific aster	<i>Lappula squarrosa</i>	European stickseed
<i>A. foliaceus</i>	Leafybract aster	<i>Lepidium lasiocarpum</i>	Peppergrass
<i>Astragalus</i> spp	Milkvetch	<i>Linanthus septentrionalis</i>	Linanthus
<i>Chenopodium</i> spp	Goosefoot	<i>Machaeranthera</i>	Tansy-leaf aster
		<i>Tanacetifolia</i>	
<i>Cleome lutea</i>	yellow beeplant	<i>Malcomia africana</i>	African mustard
<i>Descurainia pinnata</i>	tansy mustard	<i>Melilotus officinalis</i>	Sweet clover
<i>D. sophia</i>	Flixweed	<i>Penstemon palmeri</i>	Beards tongue
<i>Erigeron speciosus</i>	Oregon daisy	<i>Phacelia heterophylla</i>	Scorpion weed
<i>Eriogonum</i> spp	Buckwheat	<i>Plantago patagonica</i>	Patagonia plantain
<i>Haplopappus clematis</i>	clement goldenweed	<i>Polygonum aviculare</i>	Knotweed
<i>H. spp</i>	Goldenweed	<i>Sphaeralcea</i>	Gooseberry-leaved
		<i>Grossulariaefolia</i>	globemallow
<i>Helianthus annuus</i>	Common sunflower	<i>Tragopogon dubius</i>	Oyster-plant
<i>Heterotheca villosa</i>	hairy golden aster		
CACTUS			
<i>Opuntia polyacantha</i>	Beavertail	<i>Sclerocactus whipplei</i>	Fishhook
WEEDS			
<i>Halogeton glomeratus</i>	Halogeton	<i>Salsola kali</i>	Russian thistle
<i>Kochia americana</i>	Summer cypress		

Table 3-2. Average Percent Plant Cover at the J.B. King site, June 1998

Ground Cover Type	Plant Species	Mine Site (% cover)	Reference Area (% cover)	
Shrubs	<i>Artemisia nova</i>	0.1	3.4	
	<i>Atriplex canescens</i>	10.5		
	<i>Atriplex confertifolia</i>	0.7		
	<i>Atriplex gardneri</i>	0.8		
	<i>Ceratoides lanata</i>	0.3		
	<i>Chrysothamnus nauseosus</i>	0.1		
	<i>Chrysothamnus greenei</i>	0.1		
	<i>Gutierrezia sarothrae</i>	0.3		
	<i>Opuntia polyacantha</i>			0.8
	<i>Sarcobatus vermiculatus</i>	1.0		0.1
	Total	13.9	4.3	
Grasses	<i>Agropyron trichophorum</i>	2.4	6.3	
	<i>Agropyron sp.</i>	0.2		
	<i>Bouteloua gracilis</i>	Trace		
	<i>Buchloe dactyloides</i>			1.6
	<i>Hilaria jamesii</i>	0.2		2.1
	<i>Hordeum jubatum</i>			1.5
	<i>Oryzopsis hymenoides</i>	0.9		0.3
	<i>Sitanion hystrix</i>	0.2		
	<i>Sporobolus cryptandrus</i>	0.4		0.8
	<i>Stipa comata</i>	0.1		
	Total	4.4	6.3	
Forbs	<i>Cryptantha sp.</i>		0.1	
	<i>Haplopappus clematis</i>	Trace		
	<i>Langlosia sp.</i>		Trace	
	<i>Lappula squarrosa</i>	0.1	0.2	
	<i>Plantago sp.</i>		0.2	
	<i>Phacelia sp.</i>		0.1	
	<i>Sphaeralcea coccinea</i>	Trace	1.6	
	<i>Townsendia sp.</i>		0.2	
	Total	0.1	2.5	
Desirable Plant Cover		18.4	13.1	
Weeds		1.2	0.0	
Standing Dead		7.3	3.8	
Litter		7.6	4.6	
Rock		24.2	5.6	
Bare ground		41.3	72.9	

The table also lists each shrub species as a percent of total number of shrubs. Total shrub density was measured at 2875 shrubs per acre on the mine site and 8400 shrubs per acre on the reference area. A greater variety of shrubs were present on the mine site as compared to the reference area.

On the mine site, four-wing saltbush (*Atriplex canescens*) was the most abundant woody plant species measured at 51% of the shrub composition and an average density of 1475

shrubs per acre. Greasewood (*Sarcobatus vermiculatus*) was the second most abundant species comprising 15% of the total and 450 shrubs per acre.

We determined a total of 8400 shrubs per acre for the reference area. There were numerous small shrubs uniformly distributed on this area. Only 3 different shrub species were present. Shadscale (*Atriplex confertifolia*) had 69% of the total number of shrubs and 5800 shrubs per acre. Broom snakeweed (*Gutierrezia sarothrae*) had 29% of the total and 2400 shrubs per acre. Cactus (*Opuntia* sp.) comprised 2% of the total and 200 plants per acre.

Table 3-3. Shrub Density for the J.B. King site, June 1998

Shrub Species On Mine Site	Number of Shrubs per			Percent Composition
	4 m ²	Hectare	Acre	
<i>Atriplex canescens</i>	1.475	3687.5	1475	51.30
<i>Sarcobatus vermiculatus</i>	0.425	1062.5	425	14.78
<i>Ceratoides lanata</i>	0.350	875.0	350	12.17
<i>Atriplex confertifolia</i>	0.175	437.5	175	6.09
<i>Atriplex gardneri</i>	0.175	437.5	175	6.09
<i>Gutierrezia sarothrae</i>	0.125	312.5	125	4.35
<i>Chrysothamnus nauseosus</i>	0.075	187.5	75	2.61
<i>Artemisia nova</i>	0.025	62.5	25	
<i>Chrysothamnus viscidiflorus</i>	0.025	62.5	25	0.87
<i>Sphaeralcea coccinea</i>	0.025	62.5	25	0.87
Total for Mine Site	2.875	7187.5	2875	100.00
Shrub Species On Reference Area	Number of Shrubs per			Percent Composition
	1.0 m ²	Hectare	Acre	
<i>Atriplex confertifolia</i>	1.450	14500.0	5800	69.05
<i>Gutierrezia sarothrae</i>	0.600	6000.0	2400	28.57
<i>Opuntia</i> sp.	0.050	500.0	200	2.38
Total for Reference Area	2.100	21000.0	84000	100.00

3.3 Sample Adequacy

We calculated plant cover sample adequacies for this sampling period as follows;

For the J. B. King site:

$$n_{\min} = \frac{1.31^2 \times 6.6^2}{(0.1 \times 18.4)^2} = 22$$

At least 22 samples were need. Since we did 40 samples, no more samples were needed.

For the reference area:

$$n_{\min} = \frac{1.31^2 \times 2.4^2}{(0.1 \times 13.1)^2} = 6$$

At least 6 samples were need for sample adequacy, 10 to met The Division's requirements. Since we did 20 samples, no more samples were needed.

4.0 DISCUSSION

Our monitoring survey determined plant cover, shrub density, proper sampling technique including sample adequacy, and an overall visual survey of the J.B. King Mine site. Vegetative cover on the site was 18.4 % and the shrub density was 2875 shrubs per acre. Sample adequacy was met. Our visual survey showed the site's productivity, diversity, and habitat potential to be good.

4.1 Plant Cover and Shrub Density

The average plant cover on the mine site was 19.6 %. This plant cover broke down into:

- 71 % shrubs
- 3 % grasses
- < 1 % forbs
- 6 % weeds

Average desirable plant cover was 18.4 %. The reference area had 13.1 % plant cover with a more even distribution between shrubs, grasses, and forbs and no significant weedy plant species. Although the site differs from the reference area in plant composition, the site has greater plant productivity and overall species diversity as compared to the reference area. This may be due in part to the difference in soil profile age and substrate, a topography, aspect, and elevation between the 2 sites. Also, the mine site is in a successional stage of vegetation development and protected from livestock grazing. The reference area is a mature plant community and stable for plant cover and density.

Shrub density is higher on the reference area as compared to the mine site, 2875 and 8400

shrubs per acre respectively. The shrubs on the mine site as compared to the reference area have:

- wider spaces between the plants
- a more random pattern
- a greater diversity
- larger individual plants

Shrub diversity on the site was 10 species of shrubs and half-shrubs compared to 3 species on the reference area. Shrubs on the reference area were small and uniformly spaced.

The number of samples we took was adequate according to the formula recommended by the Division. We used a larger quadrat on site compared to the reference area to allow for the greater variability in plant growth within the microcommunities present on the reclaimed mine site. We observed a good growth of vegetation, particularly grasses, and attributed the good growth to adequate winter moisture during the past few years.

4.2 Visual Survey

We evaluated the reclaimed J.B. King Mine site for the vegetative condition and diversity, animal habitat potential, domestic livestock grazing, and erosion control. The site has good vegetative cover and diversity as compared to the surrounding countryside. The site's potential as animal habitat is good. In general, the site is being well maintained for exclusion of cattle grazing and control of erosion (see Bamberg and Hanne, 1992b).

The vegetation on the site is generally in good condition and highly productive after a good supply of moisture during the past winter. In particular, most grass species flowered and set abundant seed. Plant diversity has increased as evidenced by the non-seeded, native species present and the high numbers of seed producing grasses. Our plant monitoring surveys confirm our visual observations that plant cover is stable and productive. The mine site is in good condition with respect to species composition, cover, and ground stabilization as compared to the surrounding countryside. The surrounding native rangeland was satisfactory and had been lightly grazed in the reference area. The J.B. King mine site contains more desirable vegetation for grazing but has been protected from cattle grazing.

We observed the mine site for animals present and habitat conditions. The mine site has

grown in value as animal habitat as evidenced by an increased number of animal sign. Animal sign included elk, deer, harvester ants, cottontails and jackrabbits, and predators such as coyote and fox. We observed abundant elk droppings and grazing sign on the site, although these animals were not present at this time of year. Birds were common. We saw nighthawks, clark's nutcrackers, hummingbirds, mourning doves (nesting), sparrows, swallows and other passerine birds; raptors occur around the site and presumably hunt the site as part of their territory.

Grazing by domestic livestock was excluded from the site in 1989. Western States Minerals has the grazing rights for the property for the next two years. We saw no sign of cattle grazing on the site. The site boundary fences were in good condition and are being maintained. Western States Minerals will continue to exclude grazing for the duration of the reclamation period. A local contractor maintains the fences surrounding the area.

The site is monitored and maintained to promote revegetation and control erosion. The erosion control features, including the catchment basin and realigned channels, are intact and operating (see Figures 4-1 and 4-2). The erosion channels have stabilized and are not deepening. No roads or right-of-ways exist through the site. Machinery and vehicle use on site have been eliminated. During our survey, we saw one recent track from a four-wheeled vehicle on the site.

5.0 Conclusion

We recommend that Western States Minerals can apply for Phase II Bond release based on the vegetative cover on the J.B. King Mine site as compared to the site's reference area. The vegetative cover on the mine site is not only within 90% of the reference area, the site's plant cover exceeds that of the reference area. We measured cover on the mine site at 18.4%. The reference area had 13.1% vegetative cover. Although not required for bond release, shrub density on the site was approximately 34% of that on the reference area. Vegetation on the mine site is productive and stable and the site provides good animal habitat as compared to the surrounding area.

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Figure 3-1. Reclaimed J.B. King Site 1 showing vegetation type, topography, and drainage channels. June 25, 1998.

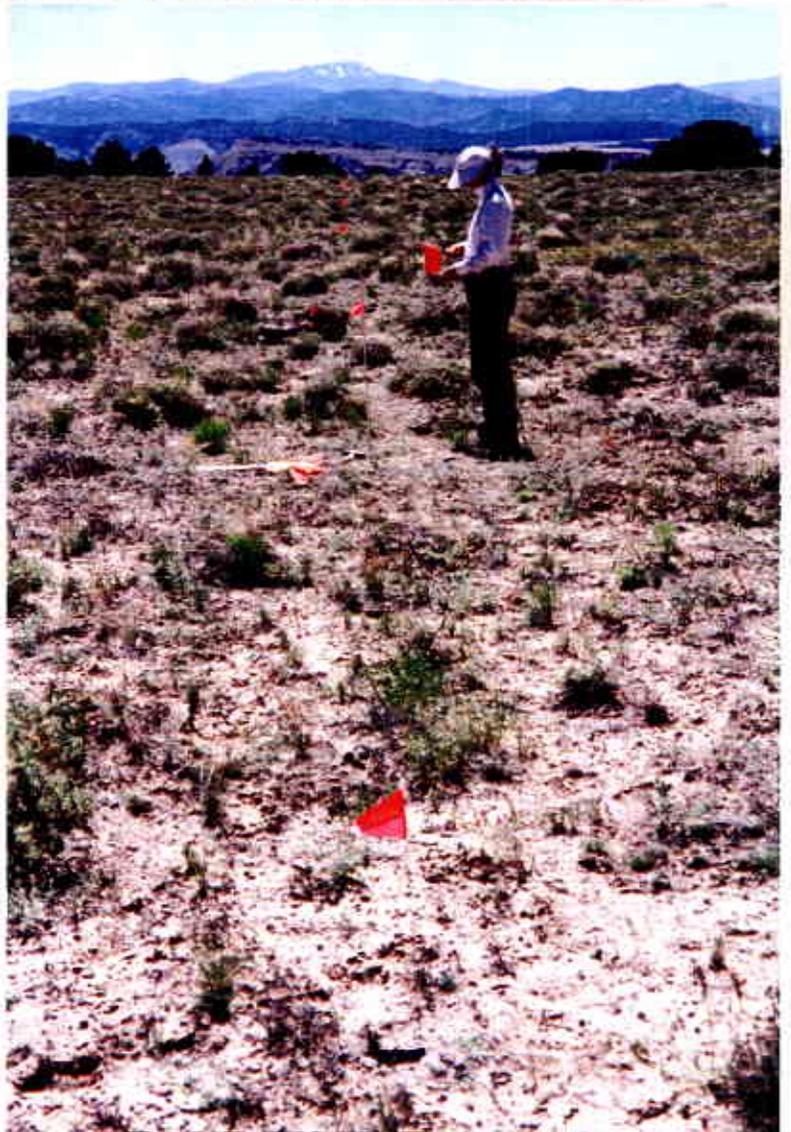


Figure 3-2. Reference area showing vegetation type and grid layout. →

Figure 3-3. View of the J.B. King site looking down drainage toward the northwest along long axis of the valley. June 25, 1998.



Figure 3-4. View of the J.B. King site looking southeast up the valley; note sediment pond in left foreground. June 25, 1998.



Figure 4-1. View of the drainage channels reconstructed in 1994; reseeded area in left center of photograph. June 25, 1998.



Figure 4-2. View of refuse area plated with rock and reseeded in 1994. June 25, 1998.

