

APPENDIX A

Vegetation Map



LEGEND

- AG AGRICULTURAL
- ASP ASPEN
- DM DISTURBED MINE SITE
- MSC MOUNTAIN SHRUB COMPLEX
- MSS MOUNTAIN SHRUB - SAGEBRUSH
- R RIPARIAN
- RA REFERENCE AREA

----- PERMIT AREA BOUNDARY



SUMMIT MINERALS, INC.

VEGETATION MAP

TT 10/22/86
 Scale: 1" : 200'
 Ref. Dwgs.:

783.19-1

APPENDIX B

U.S. Conservation Service Documentation



United States
Department of
Agriculture

Soil
Conservation
Service

SUBJECT: *Range site report*

DATE: *September 9, 1986*

TO: *Mary M. Boucek
P.O. Box 17117
Salt Lake City, Utah 84117*

*Enclosed is the material for the range site
descriptions on the mountain gravelly loam (Oak)
and the mountain gravelly loam (ARTK) sites.*

*The condition of these two sites are
good. This is based on looking at the designated
plot on September 5, 1986.*

*Tim Watson
Range Conservationist
Soil Conservation Service*



Ecological Site Description
SCS-BLM Utah
May 1981

Site Number: _____
Site Name: Mountain Grassland, Low (OK)
Habitat Type: _____

I. Physical Characteristics

A. Physiographic Features

1. This site occurs on East hills & Mountain slopes

(List geomorphic landforms and positions)

Slopes are mostly 15 to 50 percent. with inclinations up to 60%

Elevations range from _____ meters (6500ft.)
on _____ aspects to _____ meters (8500ft.) on _____
aspects.

B. Soils

1. Characteristic soils in this site are greater than 60 inches to > 60" em deep
over _____ and well drained.

They formed in residual and colluvium derived mainly
from andesite, sandstone parent materials.
and quartzite

(Briefly describe other soil properties that are characteristic of this site as applicable. Include properties such as watertable, calcareousness, texture, permeability, rockiness, alkali or salt, etc. that influence the plant community.)

The soils are a loam with 20-35% rock fragments from 0-10 inches and a clay loam with 25-50% rock fragment from 10-60 inches

The water supplying capacity is 25 to 40 cm. (10 to 16 inches). ~~Average annual soil loss in potential is approximately _____ tons/acre. The soil surface factor (SSF) in potential is _____.~~

2. Soil taxonomic units representative of this site:

<u>Taxonomic Unit</u> (List)	<u>Classification</u>	<u>Soil Survey</u>
Horrocks gravelly Loam	Typic argixerolls, Loamy-sk, Mx. fr.	Summit County Mr. Frigid

3. Other soils presently grouped into this site:

<u>Taxonomic Unit</u> (List)	<u>Classification</u>	<u>Soil Survey</u>
Horrocks Cobble, Loam	Typic argixerolls Loam, sk. frigid	Summit County
Dunford Cobble, Loam	Pachic Argixeroll fine loamy Mx. fr.	"
AYOUB	Typic Argixeroll fi. Loamy Mx. fr.	"

C. Climate Features (Describe only once for each climatic zone within the MLRA)

1. Average annual precipitation is 24 in. to 16 cm (16 to 24 in.). Approximately 40 % occurs as rain from March through June.
(month) (month)

On the average, July through Sep is (are) the driest month(s) and October through June is (are) the wettest month(s).

The mean annual air temperature is 43 °F °C and the soil temperatures are in the frigid regime.

The average freeze-free period is 60 to 90 days.

(List any other climatic features that influence the ecosystems in this zone.)

In average years, plants begin growth around April and end growth around Oct.

D. Potential Natural Plant Community

1. The dominant aspect of the plant community is Oak. The composition by air-dry weight is approximately 65 percent grasses, 15 percent forbs and 20 percent shrubs.

2. Community Composition
(Understory = 100% by wt. if a woodland site)

<u>Plant Symbol</u>	<u>Common Name</u>	<u>Percent by weight (air-dry)</u>
<u>Grass and Grass like</u> (<u>65</u>)		
CAREX	Sedge	10
AGTR	* Stolon wheatgrass	15
AGSP	Bluebunch wheatgrass	10
POA++	* Bluegrass	12
BRCAS	* Mountain brome	10
PPGG	Other perennial grasses ↓	10
	Needlegrass	
	Nodding Brome	
	Western wheatgrass	
<u>Forbs</u> (<u>15</u>)		
PPFF	Other Perennial Forbs ↓	15
	Indian paintbrush	
	Owl clover	
	Peavine	
	Meadow rue	
	Showy goldeneye	
	Aster	
	Golden rod	
	Sweetclover	
<u>Shrubs*</u> (<u>20</u>)		
QUGA	* Gambel oak	10
SYMPH	* Snow berry	5
SSSS	Other shrubs ↓	5
	Hatelope bitterbrush	
	Bitchleaf mountain mahogany	
	Oregon grape	

↓ no more than 3% for each species
*Includes forage producing trees where needed for forage interpretations. Example: Oak, maple, aspen suckers, etc.

3. Trees (Overstory)

<u>Plant Symbol</u>	<u>Common Name</u>	<u>Density (#/Ac.)</u>	<u>Percent Canopy Cover</u>	<u>Site Index</u>
* QUGA (list)	<u>Oak</u>	<u>10890</u>	<u>80</u>	<u> </u>

4. Total Annual Air-Dry Production (Understory if a woodland site)

	<u>Kg/ha</u>	<u>Lbs/Ac</u>
Favorable years	_____	<u>2300</u>
Normal years	_____	<u>1900</u>
Unfavorable years	_____	<u>1700</u>

INC

5. Ground cover in potential is approximately _____ percent.
Total canopy cover in potential is approximately _____ percent.

6. Density of major species (>10% composition by weight)

<u>Common Name</u>	<u>#/Acre</u>
Mountain Bromel	<u>6,970</u>
Bluegrass	<u>10,890</u>
Slender wheatgrass	<u>6,970</u>
Oak.	<u>10,890</u>

7. Seral Communities

- a. Grazing disclimax. As ecological condition deteriorates due to over grazing, Mountain Bromel, Slender wheatgrass will decrease while Sedges and Forbs will increase.
- b. Fire disclimax. When the potential natural plant community is burned, Oak decrease while Grasses + Forbs increase.
- c. Forbs + Shrubs are most likely to invade this site.

8. The above vegetation description is based on 4 Ten plot transects in Good condition
(# of estimates/transects/condition)

- E. Other sites that are commonly associated with this site include:
Mt Stony Loom Oak Mt Clay Mt Loom (WRS) High Mt Loom Aspen
- F. Location of typical example of this site: East with east of ...

Ecological Site Description
SCS-BLM Utah
May 1981

Site Number: _____
Site Name: Mountain Grass, Low Mountain Big Sagebrush
Habitat Type: _____

I. Physical Characteristics

A. Physiographic Features

1. This site occurs on Glacial Moraine, Glacial Outwash, Hills, Piedmont and Mountain Slopes
(List geomorphic landforms and positions)

Slopes are mostly 3 to 40 percent. with inclusions up to 60%

Elevations range from _____ meters (5600 ft.)
on N aspects to _____ meters (8000 ft.) on S
~~aspects.~~

B. Soils

1. Characteristic soils in this site are 40" to over 60" deep
over bedrock and well drained.

They formed in residuum and colluvium derived mainly
from andesite, conglomerate parent materials.
and sandstone

(Briefly describe other soil properties that are characteristic of this site as applicable. Include properties such as watertable, calcareousness, texture, permeability, rockiness, alkali or salt, etc. that influence the plant community.)

The soil is a gravelly loam with 15 to 35% rock fragments in the top 12-16 inches, and a clay loam with 15-50% rock fragments from 16 inches on down.

The water supplying capacity is 22 to 30 cm. (9 to 12 inches). Average annual soil loss in potential is approximately _____ tons/acre. The soil surface factor (SSF) in potential is _____.

D. Potential Natural Plant Community

1. The dominant aspect of the plant community is Sagebrush & grass. The composition by air-dry weight is approximately 60 percent grasses, 15 percent forbs and 25 percent shrubs.

2. Community Composition
(Understory = 100% by wt. if a woodland site)

<u>Plant Symbol</u>	<u>Common Name</u>	<u>Percent by weight (air-dry)</u>
---------------------	--------------------	------------------------------------

Grass and Grass like

(60)

1BTR*	Slender wheat grass	15
1GSP*	Bluebunch wheatgrass	15
STLF*	Letterman Needlegrass	15
PPGG	other perennial Grasses	5
	Needlegrass	15
	Bluegrass	
	Sedge	
	Brome grass	
	Gottliebush squinnetail	

Forbs

(15)

PPFF	other perennial Forbs	15
	Eriogonum	
	Geranium	
	Peavine	
	Penstemon	
	Phlox	
	Showy goldeneye	
	Hawkbeard	

Shrubs*

(25)

ARTK*	Mountain big sagebrush	15
PTKR2	Antelope bitterbrush	5
SSSS	other shrubs	5
	Dog Hair Rabbitbrush	
	Snowberry	
	Serviceberry	
	Mountain mahogany	

*Includes forage producing trees where needed for forage interpretations. Example: Oak, maple, aspen suckers, etc.

no more than 3% for each species

3. Trees (Overstory)

<u>Plant Symbol</u>	<u>Common Name</u>	<u>Density (#/Ac.)</u>	<u>Percent Canopy Cover</u>	<u>Site Index</u>
<u>(List)</u>				

4. Total Annual Air-Dry Production (Understory if a woodland site)

	<u>Kg/ha</u>	<u>Lbs/Ac</u>
Favorable years	_____	<u>1200</u>
Normal years	_____	<u>1100</u>
Unfavorable years	_____	<u>900</u>

INC < 5. Ground cover in potential is approximately _____ percent.
 Total canopy cover in potential is approximately _____ percent.

6. Density of major species (>10% composition by weight)

<u>Common Name</u>	<u>#/Acre</u>
<u>Slender wheatgrass</u>	<u>10,890</u>
<u>Needlegrass</u>	<u>6,970</u>
<u>Bluegrass</u>	<u>6,970</u>
<u>Mountain Big sagebrush</u>	<u>1,742</u>

7. Seral Communities

a. Grazing disclimax. As ecological condition deteriorates due to over grazing, Tender wheatgrass and blue bunch wheatgrass decrease while Big blue rabbitbrush and horsebrush will increase.

b. Fire disclimax. When the potential natural plant community is burned, Mountain Sagebrush will decrease while Rabbitbrush and horsebrush will increase.

c. Shrubs and forbs are most likely to invade this site.

8. The above vegetation description is based on 2 Top plot
Transects in Good condition
 (# of estimates/transects/condition)

E. Other sites that are commonly associated with this site include:
Mt. Logan (11/1/74), Mt. Connelly (11/1/74), Mt. Strong (11/1/74)

F. Location of typical example of this site: Foot of mountain in
lost hills and Sec 20 T1N R8E

Summit 1110
p 7/8

#41

HdG--Horrocks-Yeates Hollow complex, 30 to 60 percent slopes

This map unit is on ^south and west facing mountainsides. Slopes are convex with alternating convex and concave contours. The native vegetation is *oak with scattered open areas of grass and sagebrush,* mainly ~~oakbrush, sagebrush and grasses.~~ Elevation is 5,600 to 8,400 feet.

The average annual precipitation is about 18 to 25 inches, the mean annual air temperature is 42 to 45 degrees F., and the average freeze-free period is 60 to 90 days.

This unit is about 65 percent Horrocks very cobbly loam, 40 to 60 percent slopes *under oak, 20 percent slopes,* Yeates Hollow gravelly loam, 30 to 50 percent slopes, and 15 percent *under grass and sagebrush* other soils. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Hades loam on concave parts of slopes under sagebrush and grasses, and *organic surface* Harkers gravelly loam *oak* under oakbrush and *A very cobbly shallow soil on ridges and convex slopes under sagebrush*

The Horrocks soil is ~~very~~ deep and well drained. It formed in residuum and colluvium derived dominantly from andesite, sandstone and quartzite. Typically the surface layer is very dark brown very cobbly loam about 10 inches thick. The subsoil is very dark grayish brown or dark brown very cobbly clay loam ~~or very gravelly clay loam~~ about 32 inches thick. The substratum is dark brown very gravelly loam about 17 inches thick over fractured andesite.

Permeability of the Horrocks soil is moderately slow. Available water capacity is about 5 to 7 inches. Water supplying capacity is 8 to 14 inches. Effective rooting depth is 40 to 60 inches. The organic matter content in the surface layer is about 3 to 5 percent. Runoff is very rapid and the hazard of water erosion is severe.

The Yeates Hollow soil is ^{very} deep and well drained. It formed in residuum and colluvium derived dominantly from sandstone and quartzite. Typically the surface layer is very dark grayish brown gravelly loam about 7 inches thick. The upper 7 inches of the subsoil is dark brown ^{very} gravelly clay loam. The lower 46 inches is dark brown very cobbly clay to very gravelly clay loam.

Permeability of the Yeates Hollow soil is slow. Available water capacity is about 5 to 6 inches. Water supplying capacity is 9 to 13 inches. Effective rooting depth is 40 to 60 inches. The organic matter content in the surface layer is about 3 to 5 percent. Runoff is very rapid and the hazard of water erosion is very severe.

This unit is used as rangeland, wildlife habitat and recreation.

The potential plant community on the Horrocks soil is characterized by ~~mountain brome~~ ^{slender wheatgrass} ^{mountain brome}, bluegrass, slender wheatgrass, and oak. Suitability for range seeding is ~~fair~~ ^{poor} with the main limitations being rock fragments in the soil surface. ^{and slope} ~~Areas that have become heavily infested with undesirable plants can be improved by chemical or mechanical treatment and prescribed burning.~~

The potential plant community on the ^{a)} Yeates Hollow soil is characterized by slender wheatgrass, Letterman needlegrass, bluebunch wheatgrass, and mountain big sagebrush. Suitability for range seeding is ~~good~~ ^{poor due to steep slopes.} ~~Areas that have become heavily infested with undesirable plants can be improved by chemical or mechanical treatment and prescribed burning.~~

The Horrocks soil is in capability subclass VIIc, nonirrigated, and in Mountain Gravelly Loam (Oak) ~~ecological~~ ^{ecological} site. The Yeates Hollow soil is in capability subclass VIIe, nonirrigated, and in Mountain Gravelly Loam (Mountain Big Sagebrush) ~~ecological~~ ^{ecological} site.

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UMC 783.20 - FISH AND WILDLIFE RESOURCES INFORMATION

UMC 783.20(a) - GENERAL DESCRIPTION OF HABITATS

This section gives an inventory of the wildlife resources in the Summit Minerals reclamation area and evaluates the impact of the reclamation project on the fish and wildlife resources. The study includes birds, mammals, amphibians, and reptiles. Because the area to be reclaimed has been worked intermittently as a coal mine and for the extraction of sand and gravel since the late 1800's, the ecosystem has very likely stabilized itself. Therefore, the impacts of the reclamation project will be insignificant on the wildlife of the area.

METHODOLOGY

The data and information presented here are based on past surveys made in the region and in the immediate area, and on an extensive search of the literature.

AQUATIC RESOURCES

The description of the aquatic resources consists of a review of available information from previous surveys. The water quality determinations are from the SOAP study made for the Boyer Mine and from samples taken by Summit Minerals. All analyses were conducted by certified laboratories. The results of the water samples are reported in section 783.16.

TERRESTRIAL RESOURCES

The literature and the results of past surveys in the immediate area of the reclamation project have been summarized for all terrestrial vertebrates of concern. The species have been categorized to show habitat affinities, high interest species status, and potential to be disturbed. The results are reported in Tables 783.20-1 through 783.20-4 and are listed according to their ecological classification. All species whose ranges may overlap any part of the reclamation area have been considered.

The study was conducted so as to determine the probable and actual inhabitants of the area and to identify habitats essential to their presence and/or persistence. The status of each species observed or known to inhabit the reclamation area were categorized with special attention to those considered endangered, threatened, of economic value, or recreationally important.

The species were categorized by (1) habitat, (2) relative abundance, (3) resident species, (4) seasonal use, and/or (5) high interest species. The term "high interest species" relates to those animals requiring special attention by scientists and/or public management organizations because they are either endangered, threatened, protected game animals, of economic value, or recreationally important. Reasons for such a high interest designation include:

- (1) The ranges of some species are small, thereby restricting the population to a few habitats.
- (2) Even though populations may be numerically large, the ranges may be small within the entire represented area.
- (3) Regardless of population numbers or ranges, very little is known of the current status and in some instances information indicates that populations are declining.
- (4) Species are sensitive to impacts and could be put in danger of abnormal declines.
- (5) Species are either relic or may have aesthetic or scientific value.
- (6) Species are of economic value or recreationally important.
- (7) Some combination of the above.

The following sections cover the significant habitats, the interactions, and potential results of impacts on the terrestrial vertebrates. Data are summarized in tables in which high interest species are highlighted. The potential impact on high interest mammalian species during the initial phases of reclamation and prior to completion of the revegetation program have been rated on an impact scale (Table 783.20-1). The impact scale rates the degrees of harm from: No Harm = 0, to Total Loss of the Species in the Area of Concern = 10. The impact scale (Table 783.20-1) was taken from a report made for the Boyer Mine less than a quarter of a mile north of the Summit Minerals reclamation area.

Table 783.20-1.--Possible Impact of the Reclamation Project on High Interest Mammals.

<u>SPECIES</u>	<u>IMPACT SCALE (0-10)*</u>
Badger	0
Bear, Black	0
Bobcat	0
Cottontail, Nuttall's	0
Cougar (Mountain Lion)	0
Coyote	0
Deer, Mule	3
Elk or Wapiti	1
Ermine	0
Fox, Gray	0
Fox, Red	0
Hare, Snowshoe	0
Jackrabbit, Black-tailed	0
Jackrabbit, White-tailed	0
Marten	0
Moose	0
Weasel, Long-tailed	0

* 0 = No Harm 10 = Total Loss of the Species

WILDLIFE HABITAT

The reclamation area is covered in part by several important habitats that are used by species considered of high interest. Five major vegetation habitats from a faunal standpoint are considered: Pinyon-Juniper, Desert Shrub, Sagebrush, Conifer-Aspen, and Mixed Shrub and Grasses.

AQUATIC WILDLIFE HABITAT

No perennial streams pass directly through the reclamation area. Chalk Creek flows along the northern border of the project area and receives runoff from the area to be reclaimed. However, drainage from the reclaimed areas will pass through a sedimentation pond before being discharged into the creek during the 10-year period of reclamation liability. Therefore, the impact on the quality of the water in Chalk Creek will be minimal and there should be little, if any, affect on the biological community in the creek.

Chalk Creek may receive some ground water from the reclamation area. However, because the mining of coal has been discontinued and there are no toxic materials present, there will be no contamination of the ground water supply. Based on past surveys conducted on the stream, the possibility for adverse impacts is considered to be insignificant.

TERRESTRIAL WILDLIFE HABITAT

The reclamation area could potentially be inhabited by upwards of 62 avian, 52 mammalian, 12 reptilian, and 3 amphibian species. Some of those are considered to be high interest species for the habitats found in the reclamation area. The term "high interest species" indicates those animals that are economically valuable or recreationally important; have special scientific, educational, or aesthetic value; or are either endangered, threatened, or protected game species of wildlife.

Tables 783.20-2 through 783.20-4 indicate the species likely to be found in the reclamation area and give the range of mammals, reptiles, and amphibians in the five major vegetation habitats as they relate to the animals of the area.

Birds

Table 783.20-2 indicates the species of birds likely to be found in the reclamation area, the seasons during which they may be sighted, and how common they are to the area. Two of the species are on the endangered species list: (1) the bald eagle, a winter resident; and (2) the peregrine falcon, believed to be a year-round resident of north-eastern Utah. There are no known roosting trees or nesting sites in the reclamation area. Because of the transient nature of these birds no adverse impacts are expected due to the reclamation activities. However, before permanent mining operations are begun, a survey should be requested by the Raptor Biologist from the U. S. Fish and Wildlife Service.

Any possible impacts on the birds are expected to be minimal because of the large area of similar habitats in the region and the status of the birds. The overall effect of the reclamation project will be to enlarge and enhance the habitats for birds.

Table 783.20-2.--Species List, Status, and Seasonal Occupancy of Birds Whose Published Ranges Overlap the Summit Minerals Reclamation Area.

<u>NAME</u>	<u>SEASON OF OCCUPANCY</u>	<u>STATUS</u>
Bluebird, Mountain	Spring, Summer, Fall	Uncommon
Bluebird, Western	All year	Uncommon
Bushtit	All year	Uncommon
Chickadee, Mountain	All year	Common
Chukar	All year	Unknown
Crow	Spring, Fall, Winter	Common
Dove, Morning	Spring, Summer	Common
EAGLE, BALD	Winter	RARE
Eagle, Golden	All year	Uncommon
FALCON, PEREGRINE	All year	RARE
Falcon, Prairie	All year	Common
Finch, House	All year	Common
Flicker, Common	All year	Common
Flycatcher, Ash-throated	Spring, Summer	Common
Flycatcher, Gray	Spring, Summer	Uncommon
Flycatcher, Western	Spring, Summer	Uncommon
Gnatcatcher, Blue-gray	Spring, Summer	Uncommon
Grouse, Sage	All year	Uncommon
Hawk, Common Night	Spring, Summer	Common
Hawk, Ferruginous	Spring, Summer, Fall	Uncommon
Hawk, Marsh	All year	Uncommon
Hawk, Red-tailed	All year	Common
Hawk, Sparrow	All year	Common
Hawk, Swainson's	Spring, Summer, Fall	Uncommon
Hummingbird, Black-chinned	Spring, Summer	Common
Hummingbird, Broad-tailed	Spring, Summer	Common
Jay, Pinon	All year	Common
Jay, Scrub	All year	Uncommon
Kingbird, Casin's	Spring, Summer	Uncommon
Kingbird, Western	Spring, Summer	Common
Lark, Horned	All year	Common
Magpie, Black-billed	All year	Common
Nuthatch, White breasted	All year	Uncommon
Oriole, Scott's	Spring, Summer	Uncommon
Owl, Great-horned	All year	Uncommon
Owl, Long-eared	All year	Uncommon
Owl, Pigmy	All year	Uncommon
Owl, Saw-whet	All year	Uncommon
Phoebe, Say's	Spring, Summer	Common
Poor-will	Spring, Summer	Common
Raven	All year	Common
Robin	All year	Common
Shrike, Loggerhead	Spring, Summer	Uncommon
Siskin, Pine	All year	Common
Sparrow, Black-chinned	Spring, Summer	Uncommon
Sparrow, Brewer's	Spring, Summer, Fall	Uncommon
Sparrow, Chipping	Spring, Summer	Common
Sparrow, Lark	Spring, Summer	Common
Starling	Spring, Summer, Fall	Uncommon
Swallow, Violet-green	Spring, Summer	Common
Swift, White-throated	Spring, Summer	Uncommon
Titmouse, Plain	All year	Uncommon
Towhee, Rufous-sided	All year	Uncommon
Vireo, Gray	Spring, Summer	Uncommon
Vireo, Solitary	Spring, Summer	Uncommon
Vulture, Turkey	Spring, Summer, Fall	Uncommon
Warbler, Black-throated gray	Spring, Summer	Common
Waxwing, Cedar	All year	Uncommon
Woodpecker, Downy	All year	Uncommon
Woodpecker, Hairy	All year	Uncommon
Wren, Bewick's	Spring, Summer	Uncommon

Mammals

The Summit Minerals reclamation area probably contains about 52 species of mammals. Their names and ranges of habitat are given in Table 783.20-3. In all of the habitats, water is a critical resource and is possibly the limiting factor. Nineteen of the species are considered high-interest species. Fifteen of those are protected by state or federal laws.

The higher elevations of the area are used as summer range and possibly calving areas for elk and fawning areas for mule deer. The same areas are probably used by cougar, bobcat, coyote, and bear. The habitats in the foothills are utilized by elk and larger deer during the winter and spring. The lower hills are the major winter areas for mule deer.

Because the reclamation site has been used for mining since the late 1800's, and the disturbed areas are basically devoid of vegetation, the reclamation project will have a positive affect on the wildlife in the region. The overall impact on wildlife will be very positive and will more than compensate for any new, short term negative impacts during the initial phases of the reclamation project.

The expected impacts of the reclamation activities on high interest species is considered below.

Black Bear. The reclamation area provides some potential habitat for black bears, which are not abundant nor active the year around. There are two sensitive periods in the life cycle of the black bear: (1) in February and March when the cubs are born, and (2) during the early summer when the cubs accompany their mother on initial foraging expeditions. Because most of the reclamation activities will be in the late summer and/or early fall, there will be little impact during their sensitive periods.

Bobcat. The reclamation site and adjacent areas provide habitats for bobcats. Very little is know about the Utah bobcat. However, one sensitive period is late February when the kittens are born. May and June are also a sensitive period because it is then when the young bobcats are learning to hunt. However, most of the reclamation activities will be in the late summer and/or early fall and will not cause impacts on those sensitive periods.

Cottontail Rabbit. The entire reclamation site and the adjacent areas provide substantial, yearlong habitats for cottontail rabbits. The young are born between April and July, a sensitive period. The reclamation and revegetation project will enhance their habitat and provide and increased population for hunting. The timing of reclamation activities will not cause any impacts during the sensitive period.

Table 783.20-3.--Species List and Habitats of Mammals Whose Published Ranges Overlap the Summit Minerals Reclamation Area.

MAMMALS	HIGH- INTEREST SPECIES	Pinyon Juniper	Desert Shrub	Sage- brush	Conifer Aspen	Mixed Shrub & Grasses
Badger	X	CR	CR	CR	CR	CR
Bat, Big Brown						US
Bat, Brazilian Free-tailed		US	US	US		US
Bat, Hoary						US
Bat, Silver-haired						US
Bat, Townsend's Bib-eared		US		US		US
Bear, Black	X				CaR	CR
Bobcat	X	CR	CR	CR	CR	CR
Chipmunk, Cliff		CR	CR			CR
Chipmunk, Least		AR	AR	AR	CR	CR
Chipmunk, Uinta		AR	AR	AR	CR	CR
Cottontail, Nuttall's	X				UR	UR
Cottontail, Desert	X	CR	CR	CR		
Cougar (Mountain Lion)	X	UR	UR	UR	UR	UR
Coyote	X	CR	CR	CR	CR	CR
Deer, Mule	X	CR	CR	CR	CR	CR
Ermine	X				UR	
Elk or Wapiti	X					CW
Fox, Gray	X		UR	UR		UR
Fox, Red	X		CaR	CaR		CaR
Gopher, Northern Pocket			CR	CR		CR
Hare, Snowshoe	X				CR	CR
Jackrabbit, Black-tailed	X	CR	CR	CR		
Jackrabbit, White-tailed	X		UR	UR		UR
Marmot, Yellow-bellied					CR	CR
Marten	X				CaR	
Moose	X					CR
Mouse, Canyon		CR				
Mouse, Deer		AR	AR	AR	AR	AR
Mouse, Great Basin Pocket			CR	CR		
Mouse, Western Harvest			UR	UR		
Myotis, California		US	US	US		
Myotis, Fringed		US	US	US		
Myotis, Little Brown		CS	CS	CS		CS
Myotis, Small-footed			US	US		
Porcupine		CR			CR	CR
Raccoon		Ca				Ca
Rat, Ord's Kangaroo			CR	CR		
Ringtail		UR	UR	UR	UR	UR
Shrew, Dusky						UR
Shrew, Masked						UR
Shrew, Merriam		UR	UR	UR		UR
Skunk, Striped	X	CR	CR	CR	CR	CR
Squirrel, White-tailed						
Antelope			AR	AR		
Squirrel, Uinta Ground						CR
Squirrel, Rock						CR
Squirrel, Red					CR	
Squirrel, Northern Flying					CR	CR
Vole, Mountain					CR	CR
Vole, Sagebrush			UR	UR		
Weasel, Long-tailed	X	CR	CR	CR	CR	CR
Woodrat, Bushy-tailed				CR	CR	CR

A = Abundant C = Common U = Uncommon Ca = Casual or Rare
R = Permanent Resident S = Summer Only W = Winter Only

Cougar. The reclamation area provides a yearlong habitat for the cougar. Cougars are reported to range throughout the region. However, their movements are dictated by migration patterns, human disturbance, and the availability of their primary food, the mule deer. Because cougars are not abundant and are known to be secretive, it is important not to cause impacts during their sensitive period when the females are accompanied by young learning to hunt and survive. Unfortunately, this period in the life cycle of the cougar is difficult to determine because they are known to reproduce the year around. If the cougar population in the area was high, this would be cause for major concern. But, because their numbers are low and their ranges extensive compared to the size of the reclamation area, the cougars will continue to avoid areas with human activity. Furthermore, because the reclamation activities will be short lived and because the cougars will avoid this area, there will be little impact on the overall cougar population.

Mule Deer. The mule deer that frequent the reclamation area are considered part of a major herd by the Utah Division of Wildlife Resources (UDWR). During the 1970's, the populations of the mule deer herds in Utah decreased because of severe climatic conditions.

The mule deer probably have used the entire reclamation area. However, their use of specific habitats is seasonal. The high elevation mountain brush-grass and conifer-aspen habitats are used for summer range and fawning. The low altitude mountain brush, oak brush, and pinyon-juniper habitats are used as winter range during normal winters. During winters of excessive snowfall the deer move out of the reclamation area and go west to lower altitudes. The revegetation plan for the Summit Minerals site will result in a significant increase in winter range for the deer, because at this time there is little browse on the site. The timing of reclamation activities during late summer and early fall will not cause any impacts on the deer. Overall the reclamation project will be of direct benefit to the deer population around the site.

Snowshoe Hare. The snowshoe hare is present in and around the reclamation site. The animal depends on the conifer-aspen vegetation and also the mixed shrub and grasses habitats the year around. The revegetation schedule calls for a substantial increase in the mixed shrub and grass habitat. This should aid in the survival of the animal. Although the sensitive period for reproduction is from April 1 to August 15, there will be no serious long term impact on the snowshoe hare because of the relatively short-term reclamation activities which might take place near the end of the summer. Any negative impacts will be more than offset by the revegetation program.

Furbearers. Some portions of the reclamation site probably contain a few species commonly called the furbearers: i.e. ermine, long-tailed weasel, badger, and the striped skunk. Obviously, the breeding and the rearing of such nonmigratory species will occur within the reclamation area. However, any such animals which have managed to survive in the site as it now exists will not be bothered by the reclamation activities. Overall, the reclamation process will result in a reduction

of man's activities in the area creating a more stable habitat for such animals.

Small Mammals. Although small mammals do not qualify individually as high interest species, taken together they represent a significant part of the ecosystem. Most are herbivores and are the primary source of food for higher trophic levels; in particular, raptorial birds, canids, and felids. Therefore, they warrant consideration. The reclamation process can only help to reestablish and/or increase such animals. During the reclamation process, there is a chance that burrows will be caved and their continuity changed because of fracturing of the strata. However, this would cause only a temporary alteration in the population density and age structure, and with reduced human activity recovery would be imminent and very rapid. Furthermore, reclamation will result in increases in the present population because of the increase in favorable habitats.

Reptiles and Amphibians

Increasing elevation and latitude rapidly reduces the number and kind of reptiles and amphibians in the ecosystem. In the area under consideration, the geographical and associated climatic factors have eliminated most desert species of reptiles and amphibians. Those left are adapted either to mountain habitats or montane type habitats found in the northern areas of the state. The species of reptiles and amphibians listed in Table 783.20-4 generally have a wide distribution and are considered to be very versatile in their ability to adapt to changing habitats.

Based on a review of the literature, probably up to 12 species of reptiles and three species of amphibians inhabit the reclamation area. All reptiles and amphibians are legally protected in Utah. However, because all of the species listed are widespread throughout similar habitats in Utah, they are not treated as being high-interest species.

Reptiles. The reptiles found in the reclamation area are also found in many similar habitats. Therefore, the proposed reclamation activities will not cause serious impacts on the reptilian population. If the reclamation activities discover any denning sites, they will be preserved until proper procedures to either move the den site to a new location are implemented by proper UDWR personnel or the reclamation plan is modified so as not to disturb the den. This is relatively easy to accomplish and should not cause any great concern.

Amphibians. Because of the wide range and distribution pattern of the three amphibian species that could inhabit the reclamation area, it is doubtful if the reclamation activities would seriously impact even a small portion of the population.

Table 783.20-4.--Species List and Habitats of Reptiles and Amphibians
Whose Ranges Overlap the Summit Minerals Reclamation Area.

REPTILES	HIGH- INTEREST SPECIES	Pinyon Juniper	Desert Shrub	Sage- brush	Conifer Aspen	Mixed Shrub & Grasses
Boa, Utah Rubber					US	
Garter Snake, Wandering		US	US	US	US	US
Gopher Snake		CS	CS	CS		CS
Kingsnake, Utah Mountain		US				US
Lizard, Fence		US				US
Lizard, Mountain Short- horned		CS	CS	CS	U	CS
Lizard, Sagebrush		CS	CS	CS		CS
Milk Snake		US	US	US		
Night Snake			US	US		
Racer, Yellow-bellied or Western		US	US	US		US
Rattlesnake, Western Basin		CS	CS	CS		CS
Whipsnake, Striped		US	US	US		
<hr/>						
AMPHIBIANS						
Frog, Northern Leopard			CS	CS		
Toad, Great Basin Spadefoot			CS	CS		
Toad, Woodhouse's			US	US		

C = Common

U = Uncommon

S = Summer Only

Threatened and Endangered Species

There are no known endangered or threatened species of mammals, reptiles or amphibians in the reclamation area, nor are there any in close proximity to the area.

Raptors

Two species of endangered raptors could be found in the reclamation area. These are the bald eagle and peregrine falcon. There are no known roosting trees or nesting sites within the reclamation area. Therefore, the reclamation project should not have any adverse affects on those raptors.

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UMC 783.21 - SOIL RESOURCES INFORMATION**UMC 783.21(a) - GENERAL DESCRIPTION OF SOILS****UMC 783.21(a)(1) - Soil Map**

Plate 783.21-1 is a soil map of the reclamation area and adjacent areas. The map was made from a copy of a U. S. Soil Conservation Service (SCS) field map on an aerial photograph. The soil survey was conducted in 1985 and the information is considered to be preliminary.

UMC 783.21(a)(2) - Soil Identification and Methodology

The project area had a soil survey conducted in 1985 by the U. S. Soil Conservation Service. The soils that have been impacted by past mining operations are described herein and are shown on a preliminary soil map of the reclamation and adjacent areas (Pl. 783.21-1). More complete and detailed information is available from the Soil Conservation Service Office in Coalville.

Soil samples were taken by R. S. Kopp, Geologist, from nine sites in or adjacent to the disturbed area. The sample sites are shown on Figure 783.21-1 and details of the sample sites are given in Table 783.21-1. The samples were taken to the Utah State University Soil Testing Laboratory in Logan for analysis. The methods used to analyze the samples are outlined in the appendix to this section beginning on page 783.21-16.

UMC 783.21(a)(3) - Soil Description

Preliminary soil information collected by the U. S. Soil Conservation Service indicates that five soil series, a complex of two of the series, and two phases of a series exist in or adjacent to the disturbed areas which are the subject of this reclamation application. The soils are (1) the Toehead Loam, No. 76, (2) the Kovich Loam, No. 43, (3) the Horrocks-Yeates Hollow Complex, No. 41, and (4) the Watkins Ridge Loam, No. 82 and No. 83.

The major portion of the disturbed area is shown on the SCS air photo map as being in the Toehead loam. The road from the highway into the property crosses portions of the Kovich loam and the Watkins Ridge loam. The area above the disturbed area which provides runoff into the reclamation site is in the Horrocks-Yeates Hollow Complex.

FaB Toehead Loam - 2 to 4 percent slopes.

This very deep, well drained soil is on east facing alluvial fans and stream terraces. It formed in alluvium derived mainly from sandstone, quartzite, and shale. Slopes are mainly convex. The present vegetation is alfalfa and pasture grasses. Elevation is 5,200 to 5,800 feet. The average annual precipitation is about 14 to 18 inches, mean annual air temperature is 42 to 45 degrees F., and the average freeze-free period is 60 to 75 days.

Typically the surface of the soil is very dark grayish brown loam about 18 inches thick. The upper 8 inches of the subsoil is dark brown clay loam. The lower 34 inches is dark yellowish brown and dark brown clay loam.

Included in this unit are small areas of soils that are gravelly below about 14 inches and soils with strong lime layers at 21 to 31 inches. Included areas make up about 20 percent of the total acreage. Also included are small areas of similar soils that are free of lime throughout.

Permeability of the Toehead is moderately slow. Available water capacity is about 10 to 12 inches. Effective rooting depth is 60 inches or more. The organic matter content in the surface layer is about 2 to 5 percent. Runoff is slow and the hazard of water erosion is slight.

This unit is used for irrigated alfalfa and pasture with small grain at times. The Toehead is in capability subclass IVe, irrigated. > Prim. For.

Toehead Series. The Toehead soils are fine-loamy, mixed frigid, Cumulic Haploxerolls. A typical pedon of Toehead loam, 2 to 4 percent slopes, can be found about 2 miles south of Henefer, Utah, about 2,350 feet south and 300 feet west of the northeast corner of Section 15, T. 3 N., R. 4 E.

- AP- 0 to 7 inches; very dark grayish brown (10YR 3/2) loam, dark grayish brown (10YR 4/2) dry, weak fine subangular blocky structure that parts to weak fine granular; slightly hard, friable, slightly sticky and slightly plastic; many very fine, fine and a few medium roots; many fine pores; neutral (pH 7.0); clear smooth boundary.
- A2- 7 to 18 inches; very dark grayish brown (10YR 3/2) loam, dark brown (10YR 4/3) dry; weak, fine and medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine, fine and a few medium roots; many very fine interstitial pores; neutral (pH 7.0); clear smooth boundary.
- Bw- 18 to 26 inches; dark brown (10YR 3/3) clay loam, brown (10YR 5/3) dry; moderate, medium subangular blocky structure; hard, firm, sticky and plastic; many very fine, fine and a few medium roots; many very fine tubular pores; moderately calcareous, with disseminated carbonates; mildly alkaline (pH 7.4); clear wavy boundary.

- Bk1- 26 to 38 inches; dark yellowish brown (10YR 3/4) clay loam, yellowish brown, (10YR 5/4) dry; weak and moderate medium subangular blocky structure; hard, firm, sticky and plastic; many very fine and fine roots; many very fine irregular pores; moderately calcareous, carbonates are disseminated; moderately alkaline (pH 8.0); clear smooth boundary.
- Bk2- 38 to 45 inches; dark brown (10YR 4/3) clay loam, brown (7.5YR 5/4) dry; weak, medium, subangular blocky structure; hard, firm, sticky and plastic; common very fine and fine roots; a few very fine irregular pores; moderately calcareous, carbonates are disseminated; moderately alkaline (pH 8.0); abrupt smooth boundary.
- Bk3- 45 to 60 inches; dark brown (7.5YR 4/4) clay loam, brown (7.5YR 5/4) dry; weak, fine subangular blocky structure; hard, firm, sticky and plastic; few very fine irregular pores; moderately calcareous with disseminated carbonates; moderately alkaline (pH 8.2).

Bedrock: at a depth of 60 inches or more. The mollic epipedon is 20 to 30 inches thick. The particle-size control section averages 25 to 30 percent clay and 0 to 10 percent rock fragments. A Ck horizon is present in some pedons.

A Horizon: Hue is 10YR or 7.5YR, value is 2 or 3 moist, 4 or 5 dry, and chroma is 2 or 3 moist and dry. Texture is loam. Rock fragment content is 0 to 10 percent. Reaction is neutral or slightly alkaline.

B Horizon: Hue is 10YR or 7.5YR, value is 3 or 4 moist, 5 or 6 dry, and chroma is 2 to 4 moist and dry. Texture is loam or clay loam. Clay content is 25 to 30 percent. Rock fragment content is 0 to 10 percent. Reaction is mildly alkaline or moderately alkaline and moderately calcareous to strongly calcareous.

EKA *Al F soil* Kovich Loam - 0 to 2 percent slopes.

This soil unit is found on flood plains and on valley floors. Slopes are mainly concave. The native vegetation is mainly sedge and grass. Elevation is 6,300 to 6,700 feet. The average annual precipitation is about 18 to 25 inches, mean annual air temperature is 42 to 45 degrees F., and the average freeze-free period is 60 to 75 days.

Included throughout this unit are small areas of soil having 10 to 20 inches of peat at the surface. Mapped with the Kovich soil is a similar soil that is calcareous throughout the profile and a soil that lacks rock fragments in the lower part.

The Kovich loam soils are very deep and poorly drained and formed in alluvium from glacial outwash and streams that are derived from a wide variety of rocks. Typically the surface layer is black loam in the upper 9 inches and black or very dark brown clay loam in the lower 20 inches. The upper 15 inches of the substratum is dark brown fine sandy loam. The lower part to a depth of 60 inches is dark brown very gravelly loamy fine sand.

Permeability of the Kovich loam soil is moderately slow. Available water capacity is about 7 to 9 inches. Effective rooting depth is 60 inches for water tolerant plants but is limited to depths of 10 to 20 inches for plants that do not tolerate wetness. The organic matter content in the surface layer is about 5 to 10 percent. Runoff is slow and the hazard of water erosion is slight. A seasonal high water table is at a depth of 0 to 20 inches in all months of the year.

The unit is used for irrigated pasture and home sites. The Kovich loam is in capability unit IVw, irrigated

Kovich Series. The Kovich soils are fine-loamy, mixed, frigid Cumulic Haplaquolls. A typical pedon of Kovich loam, 0 to 2 percent slopes in an area of Kovich-Kovich wet, loams, 0 to 2 percent slopes, is about 1 1/2 miles southeast of Kimball Junction, about 800 feet east and 500 feet north of the southwest corner of Section 20, T. 1 S., R. 4 E.

- A1- 0 to 9 inches; black (10YR 2/1) loam, very dark gray (10YR 3/1) dry; weak fine granular structure; slightly hard, friable, slightly sticky and plastic; many very fine and common fine roots; slightly acid (pH 6.2); clear smooth boundary.
- A2- 9 to 22 inches; black (10YR 2/1) clay loam, very dark grayish brown (10YR 3/2) dry; common medium (7.5YR 5/6) mottles; weak medium subangular blocky structure; hard, firm, sticky and plastic; many very fine and fine roots; few very fine tubular pores; slightly acid (pH 6.4); clear smooth boundary.
- A3- 22 to 29 inches; very dark brown (10Yr 2/2) clay loam, dark brown (7.5YR 3/2) dry; few to common, fine distinct (5YR 3/4) mottles; moderate medium subangular blocky structure; very hard, firm, sticky and plastic; few very fine roots; few very fine tubular pores; neutral (pH 6.6); clear smooth boundary.
- 2C1- 29 to 44 inches; dark brown (7.5YR 4/4) fine sandy loam, brown (7.5YR 5/4) dry; common medium distinct (7.5YR 5/6) mottles; weak and moderate medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; few very fine tubular pores; 10 percent pebbles; neutral (pH 7.0); clear smooth boundary.
- 2C2- 44 to 60 inches; dark brown (10YR 4/3) very gravelly loamy fine sand, brown (10YR 5/3) dry; single grain; loose; 45 percent pebbles and 10 percent cobbles; medium acid (pH 6.1).

Bedrock: at a depth of 60 inches or more. The mollic epipedon is 24 to 33 or more inches thick. The particle size control section averages 20 to 35 percent clay and less than 35 percent rock fragments.

A Horizon: Hue is 10YR or 7.5YR, value is 2 or 3 moist, 3 or 4 dry, and chroma is 1 or 2 moist and dry. Texture is loam or clay loam. Clay content is 23 to 34 percent. Reaction is slightly acid to mildly alkaline.

2C Horizon: Hue is 10YR or 7.5YR, value is 2 to 4 moist, 4 to 6 dry, and chroma is 2 to 4 moist and dry. Texture is commonly stratified fine sandy loam, loam, very gravelly or very cobbly fine sandy loam or loamy sand. Rock fragment content is 25 to 70 percent. Reaction is neutral or slightly acid to mildly alkaline.

HdG Horrocks-Yeates Hollow Complex - 30 to 60 percent slopes.

This map unit is on south and west facing mountainsides. Slopes are convex with alternating convex and concave contours. The native vegetation is mainly oak with scattered open areas of grass and sagebrush. Elevation is 5,600 to 8,400 feet. The average annual precipitation is about 18 to 25 inches, the mean annual air temperature is 42 to 45 degrees F, and the average freeze-free period is 60 to 75 days.

This unit is about 65 percent Horrocks very cobbly loam, 40 to 60 percent slopes under oak, 20 percent Yeates Hollow gravelly loam, 30 to 50 percent slopes under grass and sagebrush, and 15 percent other soils. The components of this unit are so intricately intermingled that it was not practical to map them separately at the scale used.

Included in this unit are small areas of Hades loam on concave parts of slopes under sagebrush and grass, Harkers gravelly loam, organic surface under oak, and a very cobbly shallow soil on ridges and convex slopes under sagebrush.

The Horrocks soil is deep and well drained. It formed in residuum and colluvium derived dominantly from andesite, sandstone, and quartzite. Typically the surface layer is very dark brown very cobbly loam about 10 inches thick. The subsoil is very dark grayish brown or dark brown very cobbly clay loam about 32 inches thick. The substratum is dark brown very gravelly loam about 17 inches thick over fractured andesite. Permeability of the Horrocks soil is moderately slow. Available water capacity is almost 5 to 7 inches. Water supplying capacity is 8 to 14 inches. Effective rooting depth is 40 to 60 inches. The organic matter content in the surface layer is about 3 to 5 percent. Runoff is very rapid and the hazard of water erosion is severe.

The potential plant community on the Horrocks soil is slender wheatgrass, bluegrass, mountain brome, and oak. Suitability for range seeding is poor with the main limitations being rock fragments in the soil surface and slope.

The Yeates Hollow soil is very deep and well drained. It formed in residuum and colluvium derived dominantly from sandstone and quartzite. Typically the surface layer is very dark grayish brown gravelly loam about 7 inches thick. The upper 7 inches of the subsoil is dark brown very gravelly clay loam. The lower 46 inches is dark brown very cobbly clay to very gravelly clay loam.

Permeability of the Yeates Hollow soil is slow. Available water capacity is about 5 to 6 inches. Water supplying capacity is 9 to 13 inches. Effective rooting depth is 40 to 60 inches. The organic matter content in the surface layer is about 3 to 5 percent. Runoff is very rapid and the hazard of water erosion is very severe.

The potential plant community on the Yeates Hollow soil is slender wheatgrass, Letterman needlegrass, bluebunch wheatgrass, and mountain big sagebrush. Suitability for range seeding is poor because of the steep slopes.

The Horrocks-Yeates Hollow Complex unit is used as rangeland, wildlife habitat, and recreation.

The Horrocks soil is in capability subclass VIIc, nonirrigated, and in Mountain Gravelly Loam (Oak) range site. The Yeates Hollow soil is in capability subclass VIIe, nonirrigated, and Mountain Gravelly Loam (Mountain Big Sagebrush) range site.

Horrocks Series. The Horrocks soils are loamy-skeletal, mixed frigid Typic Argixerolls. A typical pedon of Horrocks very cobbly loam, 40 to 60 percent slopes in an area of Horrocks-Yeates Hollow complex, 30 to 60 percent slopes is about 3 miles southwest of Wanship, about 90 feet south and 500 feet east of the northwest corner of Section 36, T. 1 N., R. 4 E.

- A- 0 to 10 inches; very dark brown (10YR 2/2) very cobbly loam, very dark grayish brown (10YR 3/2) dry; weak fine granular structure; soft, friable, slightly sticky and slightly plastic; many very fine roots; surface mantel contains 20 percent cobbles, 30 percent pebbles; neutral (pH 7.0); clear smooth boundary.
- Bt1- 10 to 19 inches; very dark grayish brown (10YR 3/2) very cobbly clay loam, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure; hard, firm, sticky and plastic; common very fine and few fine roots; few very fine pores; common thin patchy clay films on faces of peds; 25 percent cobbles, 10 percent pebbles; neutral (pH 7.0); clear smooth boundary.

- Bt2- 19 to 32 inches; dark brown (10YR 4/3) very cobbly clay loam, brown (10YR 5/3) dry; moderate fine and medium subangular blocky structure; hard, firm, sticky and plastic; common very fine and few fine roots; common very fine and few fine pores; common thin patchy clay films on faces of peds; 25 percent pebbles, 15 percent cobbles; neutral (pH 7.0); clear smooth boundary.
- BT3- 32 to 42 inches; dark brown (10YR 4/3) very cobbly clay loam, brown (10YR 5/3) dry; weak fine subangular blocky structure; hard firm, slightly sticky and plastic; common very fine roots; few very fine pores; 20 percent cobbles, 20 percent pebbles; neutral (pH 7.0); clear smooth boundary.
- C- 42 to 59 inches; dark brown (10YR 4/3) very gravelly loam, brown (10YR 5/3) dry; weak fine subangular blocky structure that parts to weak fine granular; hard, friable, slightly sticky and slightly plastic; few very fine and fine roots; few very fine pores; 40 percent pebbles; neutral (pH 7.2); clear smooth boundary.
- R- 59 inches; andesite bedrock.

Yeates Hollow Series. These soils are clayey-skeletal, montmorillonitic, frigid Typic Argixerolls. A typical pedon of Yeates Hollow very stony loam, 15 to 40 percent slopes in an area of Yeates Hollow-Manila-Harkers complex, 15 to 40 percent slopes, is about 3 3/4 miles southwest of Wanship, about 1,400 feet west and 700 feet north of the southeast corner of Section 22, T. 1 N., R. 4 E.

- A- 0 to 12 inches; very dark grayish brown (10YR 3/2) very stony loam, dark brown (10YR 4/3) dry; moderate medium granular structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; common very fine and fine vesicular pores; 20 percent stones, 20 percent cobbles, and 15 percent pebbles; neutral (pH 6.8); clear wavy boundary.
- Bt1- 12 to 25 inches; dark brown (7.5YR 4/4) very cobbly clay, brown (7.5YR 5/4) dry; moderate coarse and medium subangular blocky structure; extremely hard, extremely firm, very sticky and very plastic; few very fine, fine and medium roots; common very fine tubular pores; common thick clay films on faces of peds; 20 percent cobbles and 20 percent pebbles; slightly acid (pH 6.2); abrupt irregular boundary.
- Bt2- 25 to 37 inches; pale brown (10YR 6/3) very cobbly clay, very pale brown (10YR 7/3) dry; strong medium and coarse angular blocky structure; extremely hard, extremely firm, very sticky and very plastic; few very fine and fine roots; common very fine tubular pores; common thin and moderately thick clay films on faces of peds; 20 percent cobbles and 20 percent pebbles; medium acid (pH 5.8); clear irregular boundary.

Bt3- 37 to 43 inches; yellowish red (5YR 4/6) extremely cobbly clay loam, reddish yellow (7.5YR 6/6) dry; strong fine subangular blocky structure; extremely hard, extremely firm, very sticky and very plastic; few very fine and fine roots; common very fine tubular pores; 60 percent cobbles and 10 percent pebbles; medium acid (pH 5.6); abrupt irregular boundary.

R- 43 inches; fractured sandstone.

Bedrock: is at a depth of 40 to more than 60 inches. The mollic epipedon is 10 to 19 inches thick. The particle-size control section averages 35 to 45 percent clay and 40 to 80 percent rock fragments.

A Horizon: Hue is 10YR or 7.5YR, value is 2 to 3 moist, 3 to 5 dry, and chroma is 2 or 3 moist and dry. Texture is very stony loam or gravelly loam. Clay content is 20 to 26 percent. Rock fragment content is 15 to 55 percent. Reaction is slightly acid or neutral.

Bt Horizon: Hue is 10YR to 5Yr, value is 3 to 6 moist, 4 to 6 dry, chroma is 3 to 6 moist and dry. Texture is very cobbly clay, very cobbly clay loam, very gravelly clay loam, and extremely cobbly clay loam. Clay content is 35 to 45 percent. Rock fragment content is 40 to 80 percent. Reaction is medium acid or neutral.

WdB Watkins Ridge Loam - 2 to 5 percent slopes.

This very deep and well drained soil is found on gently rolling foothills and alluvial fans. It was formed in alluvium derived mainly from limestone and sandstone. Slopes are concave and convex. The present vegetation is alfalfa, small grain and pasture grasses. Elevations range from 5,600 to 7,000 feet. The average annual precipitation is about 14 to 18 inches, mean annual air temperature is 42 to 45 degrees F., and the average freeze-free period is 60 to 90 days.

Typically the surface layer is a very dark grayish brown loam about 12 inches thick. The upper 4 inches of the subsoil is dark grayish brown clay loam. The lower part, to a depth of 60 inches, is yellowish brown and vary pale brown loam.

Included in this unit are small areas of Ant Flat loam on north facing slopes under big sagebrush and grasses, Richville loam on concave parts of south facing slopes under basin big sagebrush and grasses, and Watkins Ridge soil with clay loam surface texture. Included areas make up about 10 percent of the total acreage. Permeability of the Watkins Ridge soil is moderate. Available water capacity is about 8 to 9 inches. Water supplying capacity is 10 to 14 inches. Effective rooting depth is 60 inches or more. The organic matter content in the surface layer is about 1 to 4 percent. Runoff is slow and the hazard of water erosion is slight.

The unit is used for alfalfa, small grains and pasture. This Watkins Ridge soil is in capability subclass IVe, irrigated.

WdC Watkins Ridge Loam - 5 to 8 percent slopes.

This very deep and well drained soil is found on gently rolling foothills and alluvial fans. It formed in alluvium derived mainly from limestone and sandstone. Slopes are concave and convex. The present vegetation is alfalfa, small grains, and pasture grasses. The elevation is 5,600 to 6,000 feet. The average annual precipitation is about 14 to 18 inches, the mean annual air temperature is 42 to 45 degrees F., and the average freeze-free period is 60 to 90 days.

Typically the surface layer is very dark grayish brown loam about 12 inches thick. The upper 4 inches of the underlying material is dark grayish brown clay loam. The lower part to a depth of about 60 inches is yellowish brown and very pale brown loam.

Included in this unit are small areas of Ant Flat loam on northern slopes under big sagebrush and grasses and Richville Loam on concave parts of south slopes under basin big sagebrush and grasses. Included areas compose about 10 percent of the total acreage.

Permeability of the Watkins Ridge soil is moderate. Available water capacity is about 8 to 9 inches. Water supplying capacity is 10 to 14 inches. Effective rooting depth is 60 inches or more. The organic matter content in the surface layer is about 1 to 4 percent. Runoff is medium and the hazard of water erosion is moderate.

The unit is used for alfalfa, small grains and pasture. This Watkins Ridge soil is in capability subclass IVE, irrigated, and VIe, nonirrigated. It is in Upland Loam (Basin Big Sagebrush) ecological site.

Watkins Ridge Series. These soils are fine-loamy, mixed, frigid Typic Calcixerolls. A typical pedon of Watkins Ridge loam in an area of Watkins Ridge-Dennot complex, 15 to 35 percent slopes, is about 1.5 miles west of Coalville, Utah, about 2,400 feet west and 1,700 feet north of the southeast corner of Section 7, T. 2 N., R. 5 E.

- A- 0 to 12 inches; very dark grayish brown (10YR 3/2) loam, brown (10YR 5/3) dry; moderate medium granular structure; slightly hard, friable, slightly sticky, slightly plastic; common very fine and fine roots; common very fine vesicular pores; slightly calcareous, lime is disseminated; mildly alkaline (pH 7.6); abrupt smooth boundary.

- Bk1- 12 to 16 inches; dark grayish brown (10YR 4/2) clay loam, pale brown (10YR 6/3) dry; strong fine and medium subangular blocky structure; hard, firm, sticky and plastic; few very fine, fine, and medium roots; common fine tubular pores; moderately calcareous, lime is disseminated; mildly alkaline (pH 7.6); abrupt smooth boundary.
- Bk2- 16 to 36 inches; yellowish brown (10YR 5/4) loam, very pale brown (10YR 7/4) dry; strong medium and coarse subangular blocky structure; hard, firm, slightly sticky and slightly plastic; few very fine, fine and medium roots; few very fine tubular pores; strongly calcareous, lime is disseminated and veined; moderately alkaline (pH 7.9); clear smooth boundary.
- Bk3- 36 to 48 inches; yellowish brown (10YR 5/4) loam, very pale brown (10YR 7/4) dry; moderate medium and coarse subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine roots; few very fine tubular pores; strongly calcareous, lime is disseminated and veined; moderately alkaline (pH 8.4); abrupt wavy boundary.
- Bk4- 48 to 60 inches; very pale brown (10YR 7/4) loam, white (10YR 8/2) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine tubular pores; strongly calcareous, lime is disseminated and veined; moderately alkaline (pH 8.4).
- Bedrock: is at a depth of 60 inches or more. The mollic epipedon is 8 to 12 inches thick. The particle size control section averages 18 to 34 percent clay and 0 to 20 percent rock fragments.
- A Horizon: Hue is 10YR or 7.5Yr, value is 4 or 5 dry, 3 or 4 moist, and chroma is 2 or 3 dry and moist. Texture is loam. Clay content is 18 to 24 percent. Rock fragment content is 0 to 10 percent. Reaction is slightly calcareous and mildly alkaline.
- Bk Horizon: Hue is 10YR or 7.5YR, value is 6 to 8 dry, 4 to 7 moist, and chroma is 2 to 5 dry and moist. Texture is loam, silt loam, clay loam, and gravelly clay loam. Clay content is 22 to 32 percent. Rock fragment content is 5 to 15 percent. Reaction is mildly alkaline or moderately alkaline and moderately calcareous to strongly calcareous.

UMC 783.21(a)(4) - Productivity of Existing Soils

U. S. Soil Conservation Service Ecological Site descriptions indicate that some portions of the Summit Minerals reclamation area are in a Mountain Gravelly Loam (Mountain Big Sagebrush) site and other portions are in a Mountain Gravelly Loam (Oak) site. The sites occur on mountain slopes and foothills with slopes that are mostly 3 to 40 percent with inclusions up to 60 percent. The characteristic soils in the sites are 40 inches to over 60 inches deep over bedrock and are well drained. The soils formed in residuum and colluvium derived mainly from andesite, conglomerate, and sandstone. The productivity of the soils is as follows:

<u>Type of Year</u>	<u>Mountain Big Sagebrush (Lbs./Acre)</u>	<u>Oak (Lbs./Acre)</u>
Favorable years	1,200	2,300
Normal years	1,100	1,900
Unfavorable years	900	1,700

UMC 783.21(b) - SUPPLEMENT OR SUBSTITUTE FOR TOPSOIL

Because no topsoil was stockpiled since the area was first used for coal mining almost 100 years ago, Summit Minerals proposes to use the material presently at the surface after scraping off portions of the very uppermost layers which may have become contaminated with coal fines or other undesirable materials. Discussions with Tim Watson of the Coalville Office of the U. S. Soil Conservation Service, James Leatherwood, Soil Scientist, Utah Division Oil, Gas, and Mining, Lynn Kunzler, Reclamation Biologist, Utah Division Oil, Gas, and Mining, and Mary M. Boucek, Consulting Wildlife and Reclamation Biologist, indicate that the material presently on the surface of the area probably will be able to support an active plant community as a result of the proposed revegetation program.

In order to ascertain what amendments and fertilizers will be needed to help promote the new vegetation to be planted, five soil samples were taken from the disturbed area (numbers 5 through 9), two samples were from along the border of the disturbed area where revegetation has started naturally (numbers 1 and 4), and two samples were from the reference area (numbers 2 and 3). Figure 783.21-1 shows the location of the samples and Table 783.21-1 gives details of the sample procedures and sites. Table 783.21-2 gives the results of the analyses.

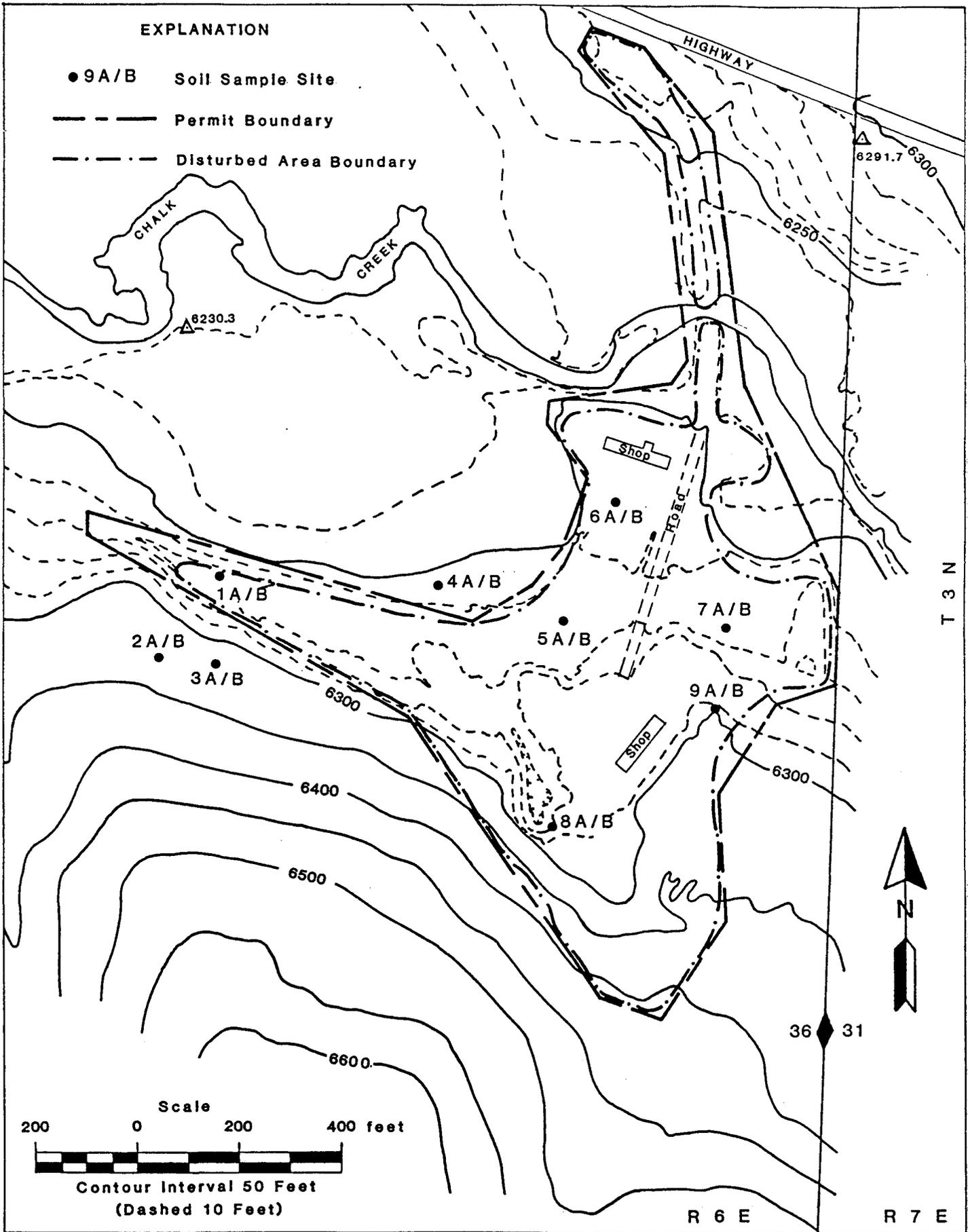


Figure 783.21-1.--Location of soil samples for Summit Minerals reclamation project.

Table 783.21-1.--Soil Sample Record Indicating Depth, Location, and Type of Sample for Summit Minerals Reclamation Project.

COMPANY: Summit Minerals, Inc., 221 West 2100 South DATE: SEPT. 9, 1986
Salt Lake City, Utah 84115
 SITE: Summit Minerals #1 Coal Mine Disturbed Area

SAMPLE NUMBER	DEPTH (in inches)	LOCATION	TYPE OF SAMPLE
#1A	0 - 6	West end of disturbed area. (Possible test site)	Shovel and pick.
#1B	6 - 12	Same as #1A.	Same as #1A.
#2A	0 - 9	Reference Area - in Brush.	Cylindrical auger.
#2B	9 - 15	Same as #2A.	Same as #2A.
#3A	0 - 12	Reference Area - Grass area.	Cylindrical auger.
#3B	12 - 21	Same as #3A.	Same as #3A.
#4A	0 - 6	Along Fence North of Pipeline.	Shovel and pick.
#4B	6 - 12	Same as #4A.	Same as #4A.
#5A	0 - 6	Near Center of Pad.	Pick and Shovel.
#5B	6 - 12	Same as #5A.	Same as #5A.
#6A	0 - 6	Just North of Sediment Pond.	Pick and Shovel.
#6B	6 - 12	Same as #6A.	Same as #6A.
#7A	0 - 6	Crusher Site Near Power Pole.	Pick and Shovel.
#7B	6 - 9	Same as #7A.	Same as #7A.
#8A	0 - 9	Fill in Front of Black Hawk Portal #1.	Channel.
#8B	9 - 21	Same as #8A.	Same as #8A.
#9A	0 - 9	Undisturbed Sand & Gravel Bank Back of Shop.	Channel.
#9B	9 - 21	Same as #9A.	Same as #9A.

Two samples were taken at each sample site. The "A" sample was generally of the top six to nine inches of the profile and in many instances represented the top portion of the A horizon. The "B" samples were from the next 6 to 15 inches of the profile and either represented the bottom of the A horizon or a portion of the top of the B horizon. At each site the sample was terminated because of encountering a large cobble, or in the case of the auger samples because of a large pebble.

Table 783.21-2.--Results of Soil Analyses from Summit Minerals Reclamation Area.

USU No.	Ident.	Texture*	Lime**	pH	mmhos	ppm					% > 2mm
					/cm ECe	P	K	Fe	Zn	NO ₃ -N	
86-1606	#1A	SL	0	7.3	.3	20	137	15.6	4.3	3.7	9 ^B
86-1607	#1B	SL	0	7.0	.2	23	115	30.0	1.7	.8	16 ^B
86-1608	#2A	OM	0	6.7	.4	32	365	68.8	6.5	10.2	14
86-1609	#2B	SiL	0	6.8	.2	40	346	65.2	2.6	2.6	41
86-1610	#3A	SiL	0	6.7	.3	39	>400	52.8	4.5	3.1	15
86-1611	#3B	SiL	0	6.8 ^{1.0}	.3	35	378	46.2	2.5	2.0	12
86-1612	#4A	SiL	0	7.3	.6	37	295	22.4	3.8	20.1	20
86-1613	#4B	SiL	0	7.3	.3	32	255	30.4	3.5	4.7	15
86-1614	#5A	L	++	8.0	.5	15	92	11.1	3.6	1.7	34
86-1615	#5B	L	++	7.9	.5	14	67	13.5	1.3	1.1	60 ^X
86-1616	#6A	L	+	7.6	.5	21	86	25.4	4.0	4.5	46
86-1617	#6B	L	+	7.6	.5	25	88	19.8	2.6	2.9	49
86-1618	#7A	L	++	8.2 ^{3.0}	.5	13	63	8.3	.7	2.0	53 ^X
86-1619	#7B	L	++	8.3	.4	13	67	11.2	.6	2.5	64 ^X
86-1620	#8A	SL	++	8.1	.5	16	52	7.7	.7	7.9	63 ^X
86-1621	#8B	SL	++	8.2	.4	12	51	8.4	.6	2.9	62
86-1622	#9A	L	++	8.0	.5	12	116	7.4	.8	4.7	54 ^X
86-1623	#9B	L	++	8.2	.7	5.9	56	7.2	.5	4.8	38

*SL = Sandy Loam
OM = Organic Matter
SiL = Silty Loam
L = Loam

** 0 = no lime
+ = little lime
++ = alot of lime

lwt.

*Drop in P, K, Fe, Zn
mass in non plants*

The two samples from the reference area (numbers 2 and 3) are silty loams with some concentration of organic matter in the surface layer. The plus 2 mm fraction ranges from 12 to 15 percent. The bottom sample of one (2B) had 41 percent plus 2 mm. This probably is not representative and is possibly due to several large pebbles being captured by the auger. The two border samples (numbers 1 and 4) are silty to sandy loams with plus 2 mm fractions ranging from 9 to 20 percent. The samples from the disturbed area (numbers 5 through 9) are classified as loams or sandy loams and have plus 2 mm fractions which range from 34 to 64 percent.

The reference area samples and the border samples contain no lime while those from the disturbed area have a lime content which probably ranges from 1 percent to more than 5 percent.

The reference area and border samples are neutral, having pH values which range from 6.7 to 7.3. The samples from the disturbed area are moderately alkaline with pH readings ranging from 7.6 to 8.3. Overall the pH and EC_e indicate that there are no salt problems with any of the samples.

Phosphorus values for the reference area and border area samples range from 20 to 40 ppm while those from the disturbed area samples range from 5.9 to 25 ppm. Those levels should be adequate for range revegetation purposes. The one sample (9B) which was somewhat low in phosphorus (5.9 ppm) was from the lower portions of the profile sampled and represents material from the edge of the sand and gravel deposit. A response to phosphorus fertilizer is questionable, but approximately 20-30 lbs. of phosphate per acre is probably desirable.

Potassium levels for samples from the reference area and border area were very high and ranged from 115 to more than 400 ppm. Values for the disturbed area samples ranged from 51 to 116 ppm. Generally, range revegetation efforts do not require potassium fertilization when soil test values are greater than 50 ppm.

Iron levels are considered to be more than adequate for all of the samples. The zinc content for the reference area, border area, and the two westernmost disturbed area samples (numbers 5 and 6) are high. The zinc content of the other samples are somewhat low, but are considered adequate for range revegetation efforts. Therefore, there should be no concern about iron or zinc.

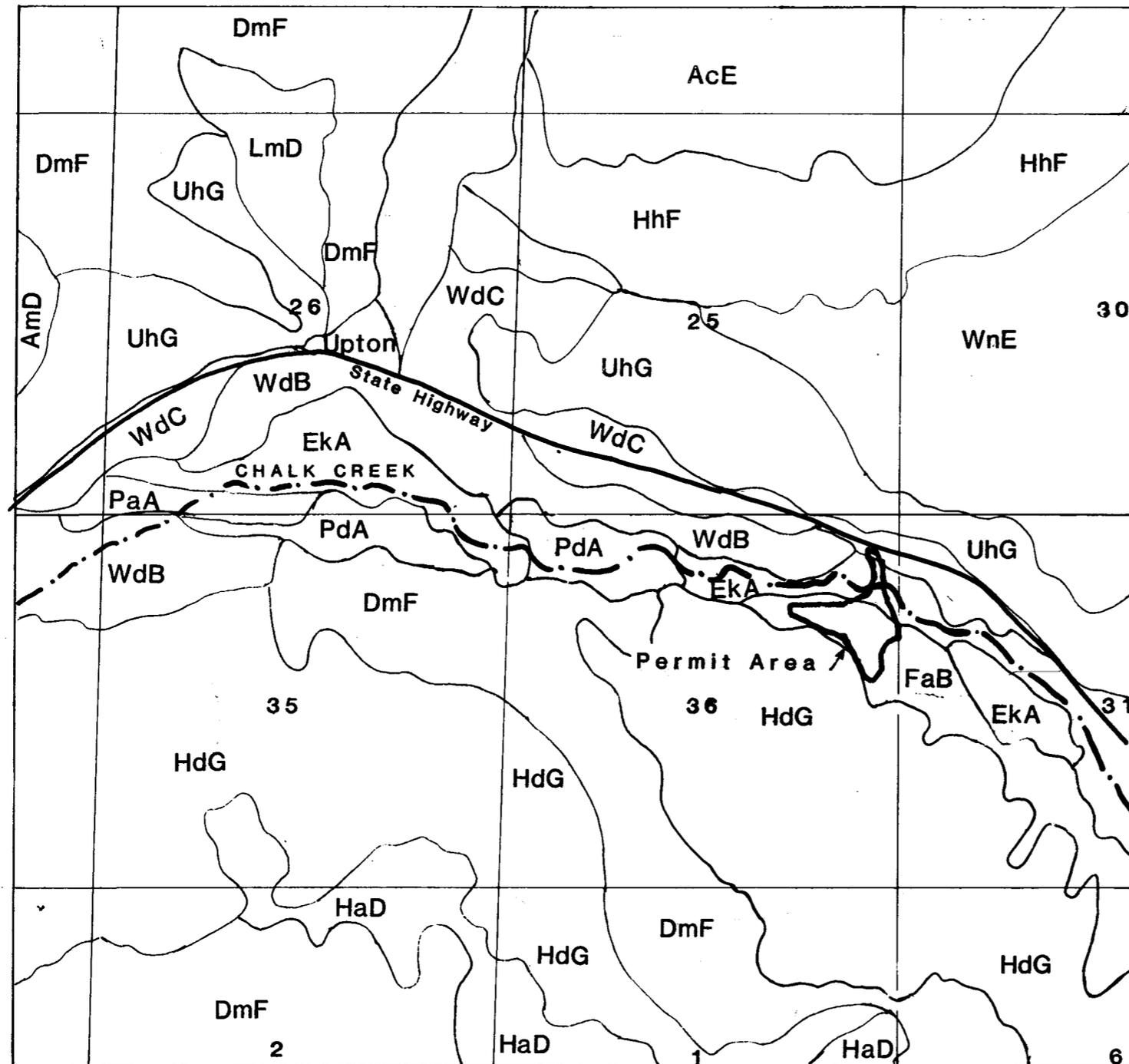
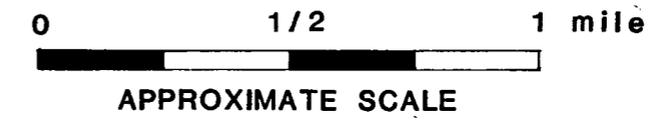
The nitrogen levels are quite variable. Overall it appears that some form of nitrogen should be applied to help make the soil more productive during the revegetation effort. James Leatherwood, DOGM Soil Scientist, has suggested that the nitrogen requirement be met by applying two tons of alfalfa per acre, which would be tilled- or ripped-in to a depth of 6 to 8 inches in the disturbed area. Such an application would also aid in overcoming the relatively high plus 2 mm fraction found throughout the disturbed area.

The appendix at the end of this section contains copies of the soil laboratory results and a letter which recommends fertilizer requirements.

R 6 E R 7 E

LEGEND

- WdB - Watkins Ridge Loam, 2-5% Slope
- WdC - Watkins Ridge Loam, 5-8% Slope
- FaB - Toehead Loam
- EKA - Kovich Loam
- HhF - Hades-Hades, Organic Surface, Complex
- DmF - Dunford Organic Surface-Dunford-Ayoub Complex
- PdA - Sowcan Loam⁽¹⁾
- UHG - Richsum-Bequinn Family-Grudge Complex
- HdG - Horrocks-Yeates Hollow Complex
- WnE - Watkins Ridge-Remmet Complex, 15-35% slopes +



T 3 N
T 2 N

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SOIL MAP OF SUMMIT MINERALS PROJECT AREA

DIVISION OF
OIL GAS & MINING

RICHARD S. KOPP
Certified Professional Geologist No. 1226
November 7, 1986

* Telephone conversation with Joe Downs, Soil Conservation Service, 5/7/87
(Watkins) fine-loamy, mixed frigid, Typic Calcixerolls
(Remmet) loamy-skeletal, mixed frigid, Typic Calcixerolls
(Sowcan) Coarse loamy mixed, Cumulic Haplokerolls

UMC 784.24 - TRANSPORTATION FACILITIES**UMC 784.24(a) - Specifications**

Road width, gradient, and surface material is shown in cross section on drawing number 784.24-1. Plan views are shown on Plate number 784.23-2. Plate number 784.23-2 shows the locations of drainageways in and around the roads.

UMC 784.24(b) - Geotechnical Analysis

The design of new roadways is not a part of this plan.

UMC 784.24(c) - Alteration of Natural Drainageways

The alteration or relocation of natural drainageways is not a part of this plan.

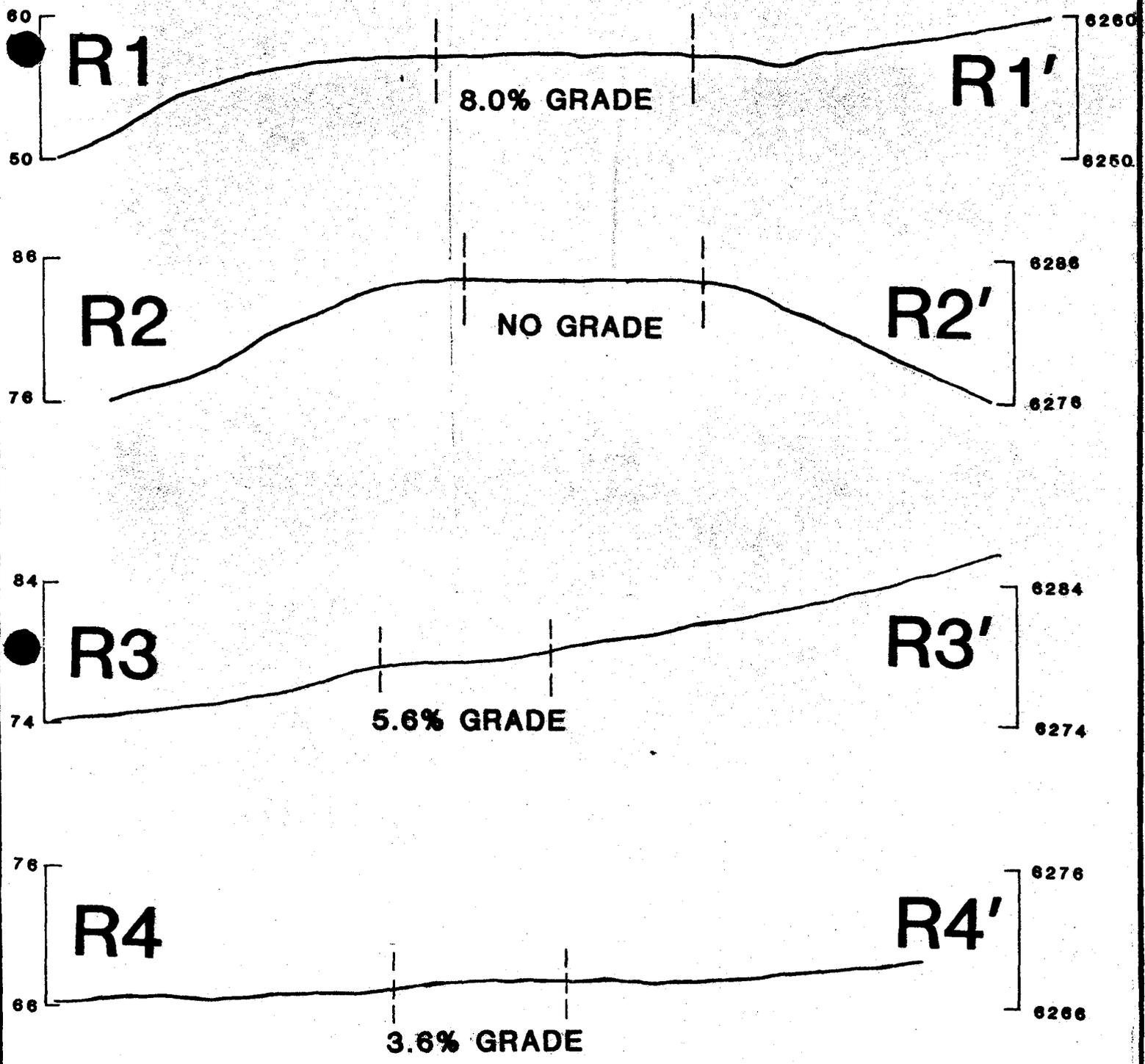
UMC 784.24(d) - Ditch Relief

Ditch relief culverts are not a part of this plan.

UMC 784.24(e) - General Description

The access road shown of Plate number 784.23-1 will not be significantly regraded during reclamation activities. The road configuration after reclamation is completed is shown on Plate number 784.23-2. Cross-sections, referenced on plate 784.23-2, are shown on drawing number 784.24-1.

The main access road accesses the buildings, which will be left after reclamation to support the post mining land use of grazing. The access road adjoins an east-west road which accesses the back country to the east and the natural gas pipeline and grazing land to the west. This road will also be left after reclamation to provide access to grazing lands.



NOTE: All roads are constructed of a gravelly loam soil type.
 There are no significant pitch grades.
 Erosion control measures are shown on the reference drawing.

THIS DRAWING WAS PREPARED UNDER MY SUPERVISION:

[Signature]
BARBARA A. FILAS
 REGISTERED PROFESSIONAL ENGINEER, UTAH NO. 7007

[Signature] 11/6/86
 DATE

SUMMIT MINERALS, INC.	
ROAD CROSS SECTIONS	
BAF 11/6/86	784.24-1
Scale: 1" : 10' H&V	
Ref.: 784.23-2	

UMC 784.26 AIR POLLUTION CONTROL PLAN

UMC 784.26(a) - Monitoring Program

The reclamation area is designated as a Class II area for preventing significant air quality deterioration. The proposed reclamation plan is not expected to significantly impact the air quality in the area. Fugitive dust is the only anticipated impact to air quality, and it will be minimized as described in part (b) of this section.

It is estimated (Aero-Vironment, 1977) that the average annual background level for total suspended particles (TSP) in northern rural Utah is 30 micrograms per cubic meter. This is significantly below the Federal secondary standard of 60 micrograms per cubic meter. Reclamation activities, using dust control methods described in section (b) as necessary, are not expected to cause TSP levels to exceed Federal standards, or exceed 20 percent opacity.

UMC 784.26(b) - Fugitive Dust Control Plan

Measures to control fugitive dust include, but will not be limited to:

1. The application of water when surface regrading and soil manipulation cause a significant increase in fugitive dust.
2. Restricting vehicular speed to reduce fugitive dust caused by travel.
3. Promptly revegetating, mulching, or otherwise stabilizing the surface of regraded areas.
4. Restricting the travel of unauthorized vehicles on other than established roads.
5. Minimizing the amount of time required for execution of reclamation activities.

REFERENCE

Aero-Vironment, Inc., 1977, Assemblage of Data on the Air Quality in Central and Southeastern Utah and Assessing the Impact of Coal Development in this Region on the Air Quality: Pasadena, California, Final Report.

SUMMIT MINERALS, INC.

221 West 2100 South
Salt Lake City, Utah 84115
(801) 486-1861

April 20, 1987

RECEIVED
APR 20 1987

DIVISION OF
OIL, GAS & MINING

Mr. Lowell P. Braxton, Administrator
State of Utah - Division of Oil, Gas, and Mining
3 Triad Center, Suite 350
355 West North Temple
Salt Lake City, Utah 84180-1203

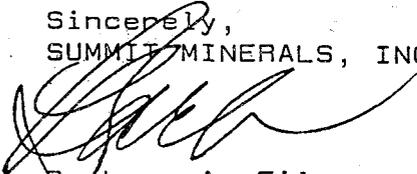
RE: Response to Technical Deficiencies, Summit No. 1 Mine
Reclamation Plan, PRO/043/001, Summit County, Utah

Dear Mr. Braxton:

Please find enclosed seven (7) copies of Summit Minerals' response to deficiencies noted in the referenced plan. Each package contains eight (8) pages for inclusion into your copies of the Reclamation Plan.

I believe that, generally, you and your staff will find these responses adequate. As we have already discussed, the response to UMC 817.132 may require some revision of the bond estimate. If that be the case, please have Randy Harden contact me for making the appropriate adjustments. Should it be necessary, I anticipate having no problem with adjusting the bond amount through permit stipulations.

Sincerely,
SUMMIT MINERALS, INC.


Barbara A. Filas
Engineer

BAF:b

enclosure

cc: J. Higgins w/o enc.

VEGETATION SURVEY AT THE SUMMIT NO. 1 COAL MINE
SUMMIT COUNTY, UTAH

submitted to
SUMMIT MINERALS, INC.

prepared by
MARY M. BOUCEK
Salt Lake City, Utah

September 1986

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INTRODUCTION

This vegetation study was conducted in order to satisfy state requirements for baseline vegetation information at the site of a previously disturbed coal mine in Summit County, Utah. The study was designed and carried out to fulfill the requirements of the Utah Coal Mining and Reclamation Permanent Program pursuant to UMC 783.19, Vegetation Information.

The Summit Minerals, Inc. No. 1 Coal Mine is an inactive underground coal mine located in Summit County in Range 6 East, Township 3 North, Section 36, SLBM, twelve miles east of Coalville, Utah. Past coal mining at the site has disturbed approximately fourteen acres and no additional surface disturbance is anticipated at this time.

METHODS

Reference Area Establishment

As the mine site has been previously disturbed, this investigation was conducted in a representative vegetation community adjacent to the disturbed area. A permanent reference area was established with the approval of Utah Division of Oil, Gas & Mining (DOGM) Reclamation Biologist, Mr. Lynn Kunzler, in the SW-1/4NE-1/4 of Section 36, above the current disturbed site, at about 6,400 feet elevation. This 2 acre reference area was marked with 1-1/4" diameter wooden survey stakes at each corner (see Appendix A, Vegetation Map). Representative slope and aspect were determined using a standard Brunton compass.

Sampling Methodology

All quantitative sampling was conducted on August 28 and 29, 1986.

COVER

A 1m² square quadrat was used to estimate vegetation cover within the reference area. At each quadrat location total vegetation cover of living vascular species within or extending into the quadrat was estimated to the nearest 1 percent. Cover of rock, litter, bare ground and cryptogams was also estimated to the nearest 1 percent. Relative cover of major life form groups (shrubs, forbs and grasses) was recorded. Cover of each species occurring within the

quadrat was also estimated as a component of total vegetative cover, the sum of which could exceed 100% depending on the degree of vegetative overlap or structural diversity.

Location of quadrats was randomized in the following manner:

Three transect lines were run in a north to south direction within the reference area (see Vegetation Map). Along each transect, 5 samples were taken, each being randomly located using a random numbers table wherein each digit represented the number of paces from point of transect origin to quadrat #1, from quadrat #1 to quadrat #2, etc.

DENSITY

Shrub density was determined by use of the point-centered quarter method (Cottam and Curtis 1956). From the center of each randomly located cover quadrat, distance to the nearest shrub was measured and recorded. Density was determined according to the formula described in Appendix 1 of the DOGM Vegetation Information Guidelines for Permanent Program Submissions for Coal Mines. Only viable shrubs greater than one foot in height were considered in the determination of density.

Density sample points #1 through #15 were randomized as described above under the cover parameter. Sample points #16 through #40 were randomized in the following manner:

An east to west transect line was selected which bisected the reference area. Along this transect, the 25 additional density sample points were randomly located using a random numbers table wherein each digit represented the number of paces from transect origin to point #16, from point #16 to point #17, etc. At each point, two 1 meter sticks were laid perpendicular to one another in order to outline individual quarters.

PRODUCTIVITY AND RANGE CONDITION

Quantitative data with regards to productivity were not collected from the area since this is a previously disturbed site. The Soil Conservation Service was contacted to conduct an on-site inspection of the reference area in order to supply a statement of estimated productivity and determination of range condition. This inspection was conducted September 5, 1986.

SAMPLE ADEQUACY

The numbers of samples required for estimating cover and shrub density in the reference area was determined by use of the following formula, as contained in DOGM Vegetation Guidelines:

$$n_{\min} = t^2 s^2 (\frac{d}{\bar{x}})^2 \text{ where,}$$

n_{\min} = minimum number of samples required

\bar{x} = sample mean

s = standard deviation of the sample

t = t value for a two tailed test at 80% confidence

d = desired change in the mean (0.1)

For the purposes of this investigation in a mountain shrub community, it was desired to detect a 10% change in the mean with 80% confidence.

Precipitation

Precipitation data were obtained from Utah Agricultural Statistics, 1985 and from direct communication with the office of the Utah State Climatologist, Logan, Utah.

Threatened and Endangered Species

Information with regards to the occurrence of threatened and endangered species in the area of the Blackhawk Mine was obtained through direct communication with the U.S. Fish and Wildlife Service, Threatened and Endangered Species Team, Salt Lake City, Utah.

Wildlife Habitat

Correlation of the vegetation community surrounding the disturbed mine area to potential wildlife habitat was accomplished through qualitative observations and direct communication with the Utah Division of Wildlife Resources, Northern Regional Resource Analyst, Ogden, Utah.

RESULTS AND DISCUSSION

Description of Affected Vegetation Community

It was determined through on site inspection of the old mine site and surrounding vegetation that predominantly the Mountain Shrub Complex community has been impacted by previous disturbance. Therefore, the two acre reference area was established within this mountain shrub complex on a northerly exposure at a slope of 15% to 40%. The mountain shrub complex (Figure 1) consists of two interspersed sub-types differentiated by slightly different soils and subsequent vegetative communities.

The mountain gravelly loam-big sagebrush sub-type is dominated by fairly evenly dispersed big sagebrush (Artemisia tridentata), low rabbitbrush (Chrysothamnus viscidiflorus) and snowberry (Symphoricarpos oreophilus). Saskatoon serviceberry (Amelanchier alnifolia) and bitterbrush (Purshia tridentata) are also well represented. The herbaceous understory is dominated by grasses, the most prevalent of which are Kentucky bluegrass (Poa pratensis), bluebunch wheatgrass (Agropyron spicatum) and Ross sedge (Carex rossii). Common forbs in this type are yarrow (Achillea millefolium), wild onion (Allium spp.), wild buckwheat (Eriogonum spp.), Lewis flax (Linum lewisii), Fendler meadowrue (Thalictrum fendleri) and several species of composite (Asteraceae).