

ATTACHMENT A

Water Quality Analysis Methods

Table 6. Field methods used for the analysis of water quality samples.

Parameter	Units	Instrument
Flow	cfs	Marsh-McBirney current meter, float measurement, or volumetric measurement
Temperature	°C	Thermometer
pH	units	Beckman Model 1009 pH meter
Conductivity	micromhos/cm @ 25°C	Hydrolab TC-2 conductivity meter

Table 7. Laboratory methods used for the analysis of water quality samples, with standard reference page numbers.

Parameter	Unit	Method	1974 EPA Methods Page No.	14th Ed. Standard Methods Page No.
Acidity, as CaCO <sub>3</sub>	mg/l	Titration	1	273
Alkalinity, as CaCO <sub>3</sub>	mg/l	Manual or automated electrometric titration to pH 4.5, or automated method	3	278
			5	---
Ammonia, as N	mg/l	Manual distillation (at pH 9.5) followed by nesslerization, titration, electrode, automated phenolate	---	410
			159	412
			165	---
			168	---
Arsenic	mg/l	Digestion followed by silver diethyldithiocarbamate, or atomic absorption	---	285
			9	283
			95	159
BOD, 5-day	mg/l	Winkler (azide modification) or electrode method	--	543
Barium	mg/l	Digestion followed by atomic absorption or colorimetric	97	152
Bicarbonate	mg/l	Titration	278	--
Boron	mg/l	Colorimetric (Curcumin)	13	287
Cadmium	mg/l	Digestion followed by atomic absorption or colorimetric	101	148
			---	182
Calcium	mg/l	Digestion followed by atomic absorption or titration	103	148
			---	182

Table 7. Continued.

Parameter	Unit	Method	1974 EPA Methods Page No.	14th Ed. Standard Methods Page No.
Chloride	mg/l	Silver nitrate, mercuric nitrate, or automated colorimetric	---	303
			29	304
			31	613
Chromium, VI	mg/l	Extraction and atomic absorption, colorimetric	89	---
			105	192
Copper	mg/l	Digestion followed by atomic absorption or colorimetric	108	148
			---	196
Cyanide	mg/l	Distillation followed by silver nitrate titration or pyridine pyrazolone (or barbituric acid) colorimetric	40	361
Fluoride	mg/l	Distillation followed by ion electrode, SPANDS, or automated complexone	---	389
			65	391
			59	393
			61	164
Gross Alpha Radioactivity	pCi/l	Scintillation counter	--	641
Gross Beta Radioactivity	pCi/l	Scintillation counter	--	642
Iron	mg/l	Digestion followed by atomic absorption or colorimetric	110	148
			---	208
Lead	mg/l	Digestion followed by atomic absorption or colorimetric	112	148
			---	215

Table 7. Continued.

Parameter	Unit	Method	1974 EPA Methods Page No.	14th Ed. Standard Methods Page No.
MPN Fecal Coliform	MPN/100 ml	MPN procedure	--	922
MPN Total Coliform	MPN/100 ml	MPN procedure	--	922
Magnesium	mg/l	Digestion followed by atomic absorption or gravimetric	114 ---	148 221
Manganese	mg/l	Digestion followed by atomic absorption or colorimetric	116 ---	148 225
Mercury	mg/l	Flameless atomic absorption	118	156
Nitrate, as N	mg/l	Cadmium reduction, brucine sulfate, automated cadmium or hydrazine reduction	201 197 207	423 427 620
Oil & Grease	mg/l	Liquid extraction with freongravimetric	229	515
Phenol	mg/l	Colorimetric (4-AAP)	241	582
Phosphate, as P	mg/l	Manual or automated ascorbic acid reduction	249 256	481 624
Potassium	mg/l	Digestion followed by atomic absorption, colorimetric or flame photometric	143 --- ---	--- 235 234
Selenium	mg/l	Digestion followed by atomic absorption	145	159
Silver	mg/l	Digestion followed by atomic absorption or colorimetric	146	148

Table 7. Continued.

Parameter	Unit	Method	1974 EPA Methods Page No.	14th Ed. Standard Methods Page No.
Sodium	mg/l	Digestion followed by atomic absorption, flame photometric	147 ---	--- 250
Sulfate	mg/l	Gravimetric, turbidimetric, or automated colorimetric	--- 277, 279	493 496
Suspended Solids	mg/l	Glass fiber filtration, 105°C	268	94
Total Suspended Solids	mg/l	Glass fiber filtration, 180°C	266	92
Total Organic Carbon	mg/l	Combustion - infrared	236	532
Turbidity	NTU	Nephelometric	295	132
Zinc	mg/l	Digestion followed by atomic absorption or colorimetric	155 ---	148 265

ATTACHMENT B

Results of Surface Water  
Quality Analysis

Table 8. Results of chemical analyses of water quality samples.

Station	S18-1	S18-1	S18-1	S18-1
Date	10/21/80	11/26/80	12/30/80	1/6/81
Flow, gpm	13	2	Seep	1
Conductance, umhos/cm (field)	---	---	750	510
Temperature, Air °C	14	5	-3	1
Temperature, Water °C	11	4	5	4
Acidity as CaCO <sub>3</sub> mg/l	12.0	28.0	<.1	8.0
Alkalinity as CaCO <sub>3</sub> mg/l	444.00	462.00	454.00	436.00
Ammonia as NH <sub>3</sub> -N mg/l	<.01	<.01	.10	<.01
Arsenic as As (Tot) mg/l	.013	.010	.001	<.001
Arsenic as As (Dissolved) mg/l	.010	.006	<.001	<.001
Barium as Ba (Dissolved) mg/l	.965	.950	.035	.040
Barium as Ba (Total) mg/l	2.500	2.810	.080	.040
Bicarbonate as HCO <sub>3</sub> mg/l	541.68	563.64	551.44	531.92
Boron as B (Dissolved) mg/l	.098	.088	.240	.220
Boron as B (Total) mg/l	.139	.150	.250	.220
Cadmium as Cd (Tot) mg/l	.002	<.001	<.001	<.001
Cadmium as Cd (Dissolved) mg/l	<.001	<.001	<.001	<.001
Calcium as Ca mg/l	124.00	188.00	117.60	108.00
Carbonate as CO <sub>3</sub> mg/l	<.01	<.01	<.01	<.01
Chloride as Cl mg/l	21.9	12.30	12.10	13.60
Chromium as Cr (Tot) mg/l	<.001	<.001	<.001	<.001
Chromium as Cr (Dissolved) mg/l	<.001	<.001	<.001	<.001
Conductivity umhos/cm	2,280	1,770	1,350	1,200
Copper as Cu (Dissolved) mg/l	.001	.002	.010	.010
Copper as Cu (Total) mg/l	.006	.005	.012	.010
Fluoride as F mg/l	.46	.39	.26	.35
Iron as Fe (Dissolved) mg/l	1.580	1.330	.150	.230
Iron as Fe (Total) mg/l	4.530	4.410	.220	.300
Lead as Pb (Dissolved) mg/l	.055	<.001	<.001	.001
Lead as Pb (Total) mg/l	.250	<.001	<.001	.002
Magnesium as Mg mg/l	106.05	117.60	114.72	134.40
Manganese as Mn (Tot) mg/l	.139	.030	.020	.015
Manganese as Mn (Dissolved) mg/l	.110	.015	.010	.010
Mercury as Hg (Tot) mg/l	.0005	.0003	<.0002	<.0002
Mercury as Hg (Dissolved) mg/l	.0003	<.0002	<.0002	<.0002
Molybdenum as Mo (Tot) mg/l	.014	.012	<.001	<.001
Molybdenum as Mo (Dissolved) mg/l	.008	.010	<.001	<.001
Nitrate as NO <sub>3</sub> -N mg/l	.76	.68	1.00	1.06
Oil and Grease mg/l	.60	1.50	1.60	.80
Phosphate PO <sub>4</sub> -P Ortho mg/l	.020	.050	.050	<.001
Phosphate as PO <sub>4</sub> -P (Total) mg/l	.090	.140	.130	.100
Potassium as K mg/l	54.80	7.70	4.65	7.20
Selenium as Se (Tot) mg/l	<.001	<.001	.004	.004
Selenium as Se (Dissolved) mg/l	<.001	<.001	.004	.006
Silver as Ag (Dissolved) mg/l	<.001	<.001	<.001	<.001
Silver as Ag (Total) mg/l	<.001	<.001	<.001	<.001
Sodium as Na mg/l	215.80	52.50	20.06	48.60
Sulfate as SO <sub>4</sub> mg/l	770	566	330	300
Suspended Solids mg/l	43.0	14.0	5.0	11.0
Total Dissolved Solids mg/l	1,560	1,220	890	840
Total Kjeldahl Nitrogen mg/l	.10	.11	.25	<.01
Zinc as Zn (Dissolved) mg/l	.228	.002	.012	.012
Zinc as Zn (Total) mg/l	.456	.125	.030	.015
pH Units	7.20	7.25	7.10	7.40

Table 8. Continued.

Station	S34-1	36-1	31-1	33-1
Date	12/22/80	12/22/80	12/22/80	12/22/80
Flow, gpm	10	----	----	----
Conductance, umhos/cm (field)	----	205	198	274
Temperature, Air °C	1	0	1	2
Temperature, Water °C	2	2	2	3
Acidity as CaCO <sub>3</sub> mg/l	<.1	<.1	<.1	10.0
Alkalinity as CaCO <sub>3</sub> mg/l	390.00	214.00	204.00	310.00
Ammonia as NH <sub>3</sub> -N mg/l	<.01	<.01	<.01	.40
Arsenic as As (Tot) mg/l	.001	.004	.007	.008
Arsenic as As (Dissolved) mg/l	.001	.002	.002	.006
Barium as Ba (Dissolved) mg/l	.020	.022	.018	.035
Barium as Ba (Total) mg/l	.040	.040	.036	.050
Bicarbonate as HCO <sub>3</sub> mg/l	456.28	236.68	185.44	378.20
Boron as B (Dissolved) mg/l	.004	.016	.005	.010
Boron as B (Total) mg/l	.012	.010	.009	.013
Cadmium as Cd (Tot) mg/l	<.001	<.001	<.001	<.001
Cadmium as Cd (Dissolved) mg/l	<.001	<.001	<.001	<.001
Calcium as Ca mg/l	60.00	46.00	54.00	72.00
Carbonate as CO <sub>3</sub> mg/l	9.60	12.00	31.20	<.01
Chloride as Cl mg/l	4.00	6.00	4.00	12.00
Chromium as Cr (Tot) mg/l	.001	.001	.002	.002
Chromium as Cr (Dissolved) mg/l	<.001	<.001	.001	<.001
Conductivity umhos/cm	710	340	300	510
Copper as Cu (Dissolved) mg/l	.010	.010	.010	.010
Copper as Cu (Total) mg/l	.010	.010	.020	.020
Fluoride as F mg/l	.20	.08	.07	.09
Iron as Fe (Dissolved) mg/l	.030	.060	.060	.010
Iron as Fe (Total) mg/l	.060	.490	1.600	1.060
Lead as Pb (Dissolved) mg/l	.002	<.001	<.001	<.001
Lead as Pb (Total) mg/l	.007	.005	.018	.016
Magnesium as Mg mg/l	62.40	4.80	13.20	16.80
Manganese as Mn (Tot) mg/l	.010	.475	1.050	1.220
Manganese as Mn (Dissolved) mg/l	.010	.195	.005	.010
Mercury as Hg (Tot) mg/l	<.0002	<.0002	<.0002	<.0002
Mercury as Hg (Dissolved) mg/l	<.0002	<.0002	<.0002	<.0002
Molybdenum as Mo (Tot) mg/l	<.001	<.001	<.001	<.001
Molybdenum as Mo (Dissolved) mg/l	<.001	<.001	<.001	<.001
Nitrate as NO <sub>3</sub> -N mg/l	<.01	<.01	<.01	.02
Oil and Grease mg/l	1.20	24.20	26.20	21.40
Phosphate PO <sub>4</sub> -P Ortho mg/l	.001	.130	.060	.480
Phosphate as PO <sub>4</sub> -P (Total) mg/l	.070	.240	.420	.770
Potassium as K mg/l	2.82	11.40	11.85	30.00
Selenium as Se (Tot) mg/l	<.001	<.001	<.001	<.001
Selenium as Se (Dissolved) mg/l	<.001	<.001	<.001	<.001
Silver as Ag (Dissolved) mg/l	<.001	<.001	<.001	<.001
Silver as Ag (Total) mg/l	<.001	<.001	<.001	<.001
Sodium as Na mg/l	30.00	29.00	5.90	15.00
Sulfate as SO <sub>4</sub> mg/l	73.0	<3.0	7.0	<3.0
Suspended Solids mg/l	9.0	14.0	46.0	47.0
Total Dissolved Solids mg/l	465	220	200	330
Total Kjeldahl Nitrogen mg/l	.05	.03	.01	.05
Zinc as Zn (Dissolved) mg/l	.012	.007	.007	.005
Zinc as Zn (Total) mg/l	.018	.025	.035	.030
pH Units	7.30	8.00	8.30	7.00

Table 8. Continued.

Station	32-1	10-1	34-2
Date	12/22/80	1/6/81	1/6/81
Flow, gpm	Fond	490	90
Conductance, umhos/cm (field)	262	520	---
Temperature, Air °C	1	5	0
Temperature, Water °C	2	0	0
Acidity as CaCO <sub>3</sub> mg/l	6.0	<.1	<.1
Alkalinity as CaCO <sub>3</sub> mg/l	260.00	418.00	398.00
Ammonia as NH <sub>3</sub> -N mg/l	.20	<.01	<.01
Arsenic as As (Tot) mg/l	.001	.002	<.001
Arsenic as As (Dissolved) mg/l	<.001	<.001	<.001
Barium as Ba (Dissolved) mg/l	.040	.105	.085
Barium as Ba (Total) mg/l	.055	.105	.085
Bicarbonate as HCO <sub>3</sub> mg/l	317.20	505.08	466.04
Boron as B (Dissolved) mg/l	.015	.185	.095
Boron as B (Total) mg/l	.018	.185	.095
Cadmium as Cd (Tot) mg/l	<.001	.001	<.001
Cadmium as Cd (Dissolved) mg/l	<.001	<.001	<.001
Calcium as Ca mg/l	44.00	64.00	72.00
Carbonate as CO <sub>3</sub> mg/l	<.01	2.40	9.60
Chloride as Cl mg/l	10.00	13.50	5.64
Chromium as Cr (Tot) mg/l	.002	<.001	<.001
Chromium as Cr (Dissolved) mg/l	<.001	<.001	<.001
Conductivity umhos/cm	400	1,000	940
Copper as Cu (Dissolved) mg/l	.020	<.001	<.001
Copper as Cu (Total) mg/l	.020	.040	.010
Fluoride as F mg/l	.05	.31	.25
Iron as Fe (Dissolved) mg/l	.060	.030	.040
Iron as Fe (Total) mg/l	.360	1.880	.130
Lead as Pb (Dissolved) mg/l	<.001	<.001	.001
Lead as Pb (Total) mg/l	.004	.022	.003
Magnesium as Mg mg/l	30.00	74.40	81.60
Manganese as Mn (Tot) mg/l	.135	.085	.015
Manganese as Mn (Dissolved) mg/l	.120	.030	.010
Mercury as Hg (Tot) mg/l	<.0002	<.0002	<.0002
Mercury as Hg (Dissolved) mg/l	<.0001	<.0002	<.0002
Molybdenum as Mo (Tot) mg/l	<.001	<.001	<.001
Molybdenum as Mo (Dissolved) mg/l	<.001	<.001	<.001
Nitrate as NO <sub>3</sub> -N mg/l	.04	<.01	<.01
Oil and Grease mg/l	15.00	.80	.60
Phosphate PO <sub>4</sub> -P Ortho mg/l	.060	.020	<.001
Phosphate as PO <sub>4</sub> -P (Total) mg/l	.340	.170	.060
Potassium as K mg/l	15.00	3.95	3.26
Selenium as Se (Tot) mg/l	<.001	.004	.003
Selenium as Se (Dissolved) mg/l	<.001	.004	.001
Silver as Ag (Dissolved) mg/l	<.001	<.001	<.001
Silver as Ag (Total) mg/l	<.001	<.001	<.001
Sodium as Na mg/l	9.00	105.00	32.10
Sulfate as SO <sub>4</sub> mg/l	<3.0	265	171
Suspended Solids mg/l	9.0	127	2.0
Total Dissolved Solids mg/l	265	700	660
Total Kjeldahl Nitrogen mg/l	.04	<.01	<.01
Zinc as Zn (Dissolved) mg/l	.012	.010	.015
Zinc as Zn (Total) mg/l	.015	.050	.015
pH Units	7.30	7.80	8.00

Table 8. Continued.

Station	Well #1 Pinnacle Mine	Well #2 Pinnacle Mine
Date	8/29/80	9/7/80
Flow, gpm	----	----
Conductance, umhos/cm (field)	----	----
Temperature, Air	----	----
Temperature, Water	----	----
Acidity as CaCO <sub>3</sub> mg/l	0	0
Alkalinity as CaCO <sub>3</sub> mg/l	452.6	461.2
Ammonia as NH <sub>3</sub> -N mg/l	----	----
Arsenic as As (Tot) mg/l	0.0007	0.0013
Arsenic as As (Dissolved) mg/l	----	----
Barium as Ba (Dissolved) mg/l	----	----
Barium as Ba (Total) mg/l	<0.2	<0.20
Bicarbonate as HCO <sub>3</sub> mg/l	452.6	461.2
Boron as B (Dissolved) mg/l	----	----
Boron as B (Total) mg/l	2.680	0.7
Cadmium as Cd (Tot) mg/l	< 0.02	<0.02
Cadmium as Cd (Dissolved) mg/l	----	----
Calcium as Ca mg/l	1.0	64.50
Carbonate as CO <sub>3</sub> mg/l	0	0
Chloride as Cl mg/l	26.4	41.0
Chromium as Cr (Tot) mg/l	0.08	< 0.05
Chromium as Cr (Dissolved) mg/l	----	----
Conductivity umhos/cm	1290	1690
Copper as Cu (Dissolved) mg/l	----	----
Copper as Cu (Total) mg/l	< 0.02	< 0.03
Fluoride as F mg/l	0.30	.219
Iron as Fe (Dissolved) mg/l	----	----
Iron as Fe (Total) mg/l	0.04	< 0.05
Lead as Pb (Dissolved) mg/l	----	----
Lead as Pb (Total) mg/l	< 0.1	< 0.05
Magnesium as Mg mg/l	14.08	27.6
Manganese as Mn (Tot) mg/l	0.01	< 0.01
Manganese as Mn (Dissolved) mg/l	----	----
Mercury as Hg (Tot) mg/l	0.0035	< 0.0002
Mercury as Hg (Dissolved) mg/l	----	----
Molybdenum as Mo (Tot) mg/l	----	< 0.1
Molybdenum as Mo (Dissolved) mg/l	----	----
Nitrate as NO <sub>3</sub> -N mg/l	0.35	0.37
Oil and Grease mg/l	----	----
Phosphate PO <sub>4</sub> -P Ortho mg/l	< 0.1	< 0.1
Phosphate as PO <sub>4</sub> -P (Total) mg/l	< 0.1	< 0.1
Potassium as K mg/l	5.8	12.8
Selenium as Se (Tot) mg/l	< 0.0002	< 0.0002
Selenium as Se (Dissolved) mg/l	----	----
Silver as Ag (Dissolved) mg/l	----	----
Silver as Ag (Total) mg/l	< 0.03	< 0.01
Sodium as Na mg/l	22.8	39.8
Sulfate as SO <sub>4</sub> mg/l	251.4	483.9
Suspended Solids mg/l	4.0	105
Total Dissolved Solids mg/l	846	1164
Total Kjeldahl Nitrogen mg/l	----	0.50
Zinc as Zn (Dissolved) mg/l	----	----
Zinc as Zn (Total) mg/l	< 0.01	< 0.01
pH Units	7.5	7.7

SEDIMENTATION  
AND  
DRAINAGE CONTROL PLAN  
FOR THE  
CENTENNIAL PROJECT  
(Revised 9/28/87)

RECEIVED  
[OCT] 8 1987  
DIVISION OF OIL  
GAS & MINING

PREPARED FOR:  
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4.1 PLAN FOR CONSTRUCTION AND MAINTENANCE  
OF SEDIMENTATION PONDS

General Description

The Andalex Deadman Canyon Project will be comprised of three mines located closely together in Deadman Canyon. The Pinnacle Mine and Apex Mines are presently in operation mining the Gilson and Lower Sunnyside Seams. The other mine will be the Aberdeen Mine in the A Seam. Surface runoff from the Pinnacle Mine and Apex Mine is controlled by Settling Basin B and Pond C. Engineering Design for these ponds have been presented to the Division of Oil, Gas and Mining on 4-3-80 and 8-21-81. Surface runoff from the Aberdeen Mine will be controlled by Pond E. Designs for these basins and ponds are shown on Plates 11, 12 and 13 included herein.

The Mines are located in the Right Fork of Deadman Canyon. This is an ephemeral drainage flowing only from direct runoff and eventually reaches the Price River some 12 miles to the south. The major drainages in the minesite area will be routed under the site through large culverts. The projected minesite will have a disturbed area of approximately 24.25 acres. In order to minimize additional sediment loading to the main drainage, it is proposed to collect the runoff from this disturbed area and pass it into a settling basin & 2 separate sedimentation ponds. Berms will be placed on the lower edge of all disturbed areas to prevent runoff from reaching natural drainages before it has passed through the sedimentation ponds.

## 4.2 Sedimentation Pond Specifications

### Location

The proposed ponds are to be located superimposed over the main drainage of the Right Fork of Deadman Canyon. The main canyon drainage will be routed through a 42" culvert located under the ponds. The sites are located downslope of the disturbed areas to simplify collection of runoff water. (See attached maps)

### Design

The proposed ponds are designed to fully contain the expected runoff and sediment load from a 10 year - 24 hour precipitation event in this area. The design has been certified by a registered professional engineer.

### Construction

The construction of the ponds will be as per the specifications set forth in the Construction Specifications sheet attached to this plan.

### Capacity

Each pond is designed to contain the runoff and sediment load from a 10 year - 24 hour precipitation event in the area of drainage. In addition, each pond has an overflow capacity in excess of that required for a 25 year - 6 hour event.

### Safety Precautions

The ponds will be built as per specifications and under supervision of a qualified, registered professional engineer. The structures will be regularly inspected by a licensed individual as required by law. Ponds will be cleaned at minimum when sediment reaches 60% of designed sediment volume. Measuring devices will be installed in the ponds to show when the ponds have filled with sediment to the clean-out level. (See Plates 12 and 13).

### Monitoring

Water monitoring stations will be established at the outlet of the ponds. Sample parameters and frequencies shall be as per specification of the NPDES permit.

### Maintenance

The ponds shall be inspected after each storm and the sediment cleaned as necessary. In no event shall sediment be allowed to build beyond 60% of sediment design capacity. Sediment removed shall be disposed of at the Carbon County sanitary landfill.

### Seeding

An approved seed mix will be applied to all feasible disturbed areas in an effort to minimize erosion and sediment loading to the ponds. The proper seed mixture for this area has been obtained through the local BLM.

### Culverts

All culverts are shown on the attached maps. Calculations for sizing are also included. It should be noted that all culvert sizes were arrived at and approved through consultation with the DOGM hydrologic engineer.

### Calculations

The following sheets reflect the calculations for sizing and details of each separate pond. Attached maps show pond locations and volumes as well as watershed areas.

### Post-Mining Hydrology

Insert from Comment 784.13 (b)(1).

Comment UMC 784.13 (b)(1)  
Reclamation Plan: General Requirements - KRW

Post Mining Hydrology

Response:

Upon completion of mining activities, and following removal of surface structures, the earthwork portion of the reclamation plan will begin as described in Sec. III, E, 3. The hydrologic portion of reclamation will take place in 2 phases:

- (1) The main and side drainage channels will be restored as shown in the Sedimentation and Drainage Control Plan, and on Plate 16. Loose rock check dams will be placed at each side drainage entrance onto the reclaimed area, and at approximately 500' intervals along the restored main channel RC-1. (Typical sections of the loose rock check dams are shown in the Sedimentation and Drainage Control Plan.)

All disturbed diversions and sediment ponds "B" and "C" will also be removed at this time. Sediment Pond "E" will be enlarged, and the entire drainage above will flow into Pond "E" through the restored channel RC-1;

- (2) Once revegetation standards are met, Pond "E" will be removed, and the area reclaimed.

Surface water monitoring will continue during this time as described in Sections 2.7 and 3.7 of the M.R.P.

### 4.3 Construction Specifications

#### for Sedimentation Ponds

1. All construction of sedimentation ponds will be performed under the direction of a qualified registered professional engineer.
2. Dams shall be constructed with primary overflows 3 ft. from the top, and emergency overflows 2 ft. from the top.
3. The areas of pond construction shall be examined for topsoil, and if present in removable quantities such soil shall be removed separately and stored in an approved topsoil storage location.
4. In areas where fill is to be placed, natural ground shall be removed for at least 12" below the base of the structure.
5. Native materials will be used where practical. Fill will be placed in lifts not to exceed 15" and compacted prior to placement of next lift. Compaction of all fill materials shall be at least 95%.
6. Rip-rap will be placed at all inlets and outlets to prevent scouring. Rip-rap will consist of substantial (non-slaking) rock material of 6" or greater size.
7. Each pond shall be fitted with an inverted inlet to the primary overflow, to prevent the passage of oil into the discharge.
8. Slopes of the dams shall not be steeper than 2.0:1, inside and outside, with a total of the inslope and outslope not less than 5:1.
9. Tops and external slopes of the dams shall be planted with an approved seed mix to prevent erosion and promote stability. Compaction of the slopes shall be at least 95%.
10. Top width of dams shall be not less than  $(H + 35)/5$ .

#### 4.3.0 PRIMARY SETTLING BASINS

(Formerly Pond B)

##### General Notes

The primary settling basins (formerly Pond B) are located above Pond "C". A disturbed area of 3.90 acres drain into the settling basins as shown on Plate 8. These basins will collect sediment and runoff from this area; however, since they are a series of cells, any overflow from the basins will be cleaned and go into Pond "C".

The primary settling basins are shown on certified Plate 11. These basins will be cleaned when sediment accumulations reach 50% of the original total pond volume.

#### 4.3.1 Pond C

1. Use 1.82" for 10 year - 24 hour event
- \* 2. Disturbed Watershed - 13.79 acres
3. Runoff Curve No. = CN = 90
4. Area Runoff =  $Q$  (in.) =  $(P-0.25)^2 / (P+0.85)$ ; Where:  
 $S = (1,000/CN) - 10$   
 $P = 1.82"$   
 $Q$  (in.) =  $[1.82-0.2(1.11)]^2 / [1.82+0.8(1.11)] =$   
 $\frac{2.553}{2.709} = .94$  in. = 0.0785 ft.  
Volume = 13.79 acres x 0.0785 ft. = 1.083 acre-ft.
5. Undisturbed Watershed - 37.99 acres
6. Runoff Curve No. = CN = 70
7. Area Runoff = 37.99 ac. x 0.2 in./12 = 0.633 acre-ft.
- \*\* 8. Sediment Storage Volume  
9.89 acres x 0.1 acre-ft./acre = 0.989 acre-ft.  
60% Cleaning Point = 0.593 acre-ft.
9. Direct Precipitation into Pond  
Area of Ponds = .39 acres  
.39 acres x 1.82 in. x 1/12 ft./in. = 0.059 acre-ft.
10. Total Required Pond Volume  
 $1.083 + 0.633 + 0.593 + 0.059 =$  2.368 acre-ft.
11. Pond Volume @ Outlet  
Total Pond Volume = 2.418 acre-ft.
12. Conclusion: Pond Size is adequate to contain the runoff and sediment load from a 10 year - 24 hour precipitation event in the area of drainage to the pond.

\* Included runoff to "Primary Settling Basins" (Formerly Pond "B")

\*\* Does not include Sediment to "Primary Settling Basins".

## POND "C"

### General Notes

The sizing of Pond C is based on the drainage areas delineated on Plate 8 - "Drainage Map". As can be seen from this Plate, a portion of the minesite drainage goes into the Pinnacle Mine, the old Chidester Portal, and the Apex Mine. The actual disturbed area draining directly to Pond "C" was planimetered from this Plate and determined to be 9.89 acres. The disturbed area flowing to the "Primary Settling Basins" was measured to be 3.90 acres. This flow drains to Pond "C" and is therefore considered in the sizing; however, the projected sediment load to the Primary Settling Basins is not considered in sizing Pond "C", since the basins could be completely full of sediment before it could impact Pond "C". As stated earlier, the Primary Settling Basins will be cleaned when sediment accumulation reaches one-half of the total basin volume; therefore, sediment from this area will not impact Pond "C".

In addition, a certain amount of undisturbed area does not flow into the undisturbed drainage culverts, and thus drains onto the mine site. (see Plate 9). The portion of this drainage that flows to Pond "C" was measured at 37.99 acres, and is included in the Pond "C" sizing calculations.

Runoff Curve numbers used in the calculations were: 90 for disturbed areas, and 70 for undisturbed areas.

An "As-Constructed" plan and profile of Pond "C" is shown in Plate 12. This plate has been certified by a registered, professional engineer. Also shown on this plate is a proposed sediment marker, and maximum and cleaning point depths for sediment. The cleaning point for sediment is at 60% of the maximum design depth for sediment storage. This point will be clearly marked on the sediment marker.

Also shown on the Plate 12 is the location of each of the pond inlets. Inlets are either grouted concrete or culvert, and do not require rip-rap or other additional erosion protection.

It should be noted that the Plate 12 indicates the "As-Constructed" configuration of the pond, and not the present situation. The pond will be cleaned and sediment will be removed to restore the capacity of the pond to a minimum of that shown on the Plate.

Pond "C" will be removed during the earthwork portion of reclamation. The culvert will also be removed and the main channel restored throughout the area. All reclaimed area above will then drain into Pond "E" below.

#### 4.3.2 Pond E

1. Use 1.82" for 10 year - 24 hour event
2. Disturbed Watershed - 6.02 acres
3. Runoff Curve No. = CN = 90
4. Area Runoff = Q (in.) =  $(P-0.25)^2 / (P+0.85)$ ; Where:

$$S = (1,000/CN) - 10$$

$$P = 1.82"$$

$$Q \text{ (in.)} = [1.82 - 0.2(1.11)]^2 / [1.82 + 0.8(1.11)] =$$

$$\frac{2.553}{2.709} = .94 \text{ in.} = .0785 \text{ ft.}$$

$$\text{Volume} = 6.02 \text{ acres} \times 0.0785 \text{ ft.} = 0.472 \text{ acre-ft.}$$

5. Sediment Storage Volume

$$6.02 \times 0.075 \text{ acre-ft./acre} = 0.451 \text{ acre-ft.}$$

Note: 0.075 sediment loading factor used because much of the disturbed area (Aberdeen Mine storage yard and truck turn around) is level and will contribute little if any sediment during a 10 year - 24 hour precipitation event.

6. Direct Precipitation into Ponds

$$\text{Area of Ponds} = 0.165 \text{ acres}$$

$$0.165 \text{ acres} \times 1.82 \text{ in.} \times 1/12 \text{ ft./in.} = 0.025 \text{ acre-ft.}$$

7. Total Required Pond Volume

$$0.472 + 0.451 + 0.025 = 0.948$$

8. Pond Volume @ Outlet = 1.205 acre-ft.

9. Conclusion: Pond size is adequate to contain the runoff and sediment load from a 10 year - 24 hour precipitation event in the area of drainage to the pond.

POND "E" - PM

Post Mining Sediment Control

1. Use 1.82" for 10 year - 24 hour event.
2. Disturbed (Reclaimed) Watershed - 24.25 acres.
  - a. Runoff Curve No. = 90
  - b. runoff Volume = 1.900 ac.ft.
3. Undisturbed Watershed = 805.50 acres.
  - a. Runoff Curve No. = 70
  - b. Runoff Volume = 13.425 ac.ft.
4. Sediment Storage Volume = 2.425 ac.ft.
5. Direct Precipitation into Pond.
  - a. Use 0.5 acres
  - b.  $0.5 \text{ ac.} \times 1.82 \text{ in.} \times 1/12 = 0.076 \text{ ac.ft.}$
6. Expected Flow = 80.55 cfs
7. Velocity of Flow = 8.78 fps
8. Pond Configuration

3 cells: 60'W x 60'L x 8'D @ Overflow
9. Pond Capacity - 2.00 ac.ft.

## POND "E"

### General Notes

Pond "E" is a proposed pond to control runoff from the future Aberdeen Mine. The disturbed area planned to drain to this pond is 6.02 acres.

Plate 13 shows the plan and profile of the proposed pond. Also shown on this plate is a proposed sediment marker and the levels of the maximum sediment volume and the 60% cleaning point. Since the pond is a 2-celled type, the vast majority of sediment will be trapped in the upper cell; therefore, the sediment marker and planned sediment levels are planned for this cell only.

The dike between cells has 2 feet of gravel over the top of the core. Since the cleaning point of the pond is well below this level, water will be allowed to flow freely through the gravel; therefore, no spillway is planned for the upper to lower cell. Experience with 2 and 3 celled ponds in this area has shown that gravel dikes function adequately in normal to above design event storms, and they serve to filter the water between cells, thus allowing for a much cleaner product in the event of a discharge.

Grouted rip-rap or culvert will be used on all pond inlets; therefore, additional rip-rap or energy dissipators are not required.

Seepage collars on the main culvert beneath will be of concrete or a standard, manufactured design. Proper compaction of the pond

bottom (fill over the culvert) will prevent piping along the culvert.

An emergency spillway drop chute is planned for the pond outlet. A design drawing of this chute is attached as Figure A. This chute is equipped with block energy dissipators at the base, along with a 12" M.D. rip-rap apron. The drainage from the chute will then go into a stilling basin as shown on attached Figure A. This stilling basin will be placed approximately 40' below the outlet in the channel, and will remain in place as one of the check dams shown on Plate 17.

#### Pond E-PM

Upon reclamation, Pond "E" will be enlarged and left in place until revegetation standards are met, as shown on Plate 16. The culvert will be removed, and the pond will be re-constructed to clean and discharge. The entire runoff from the drainage area above. Pond sizing calculations are shown on the attached sheet entitled "Pond E-PM", "Post-Mining Sediment Control". Specific designs for this re-constructed pond will be submitted at a later date, when the concept of allowing the entire undisturbed and reclaimed area to drain into this one structure is approved.

The rationale for removing all upper ponds and diversions is based on the following:

- (1) Pond E is the lowermost structure, and can be rebuilt and later removed and reclaimed with minimum damage to the reclaimed site;

- (2) The upper site can be reclaimed in a more natural and permanent manner, as shown on the post-mining topography map, Plate 16, without leaving temporary structures such as diversions, ponds, etc.. Once vegetation is established, it will not have to be redisturbed.
  
- (3) The extensive use of loose-rock check dams in the restored drainages will serve as effective sediment and erosion control, and will promote the establishment of a riparian area along the drainage.

Because of the large size of the undisturbed drainage above (805.5 acres), upon reclamation, it is proposed to construct a series of filtering ponds to clean and discharge the water rather than try to fully contain the runoff. The expected flow from a 10 year - 24 hour event for the entire undisturbed and reclaimed area is 80.55 cfs at a velocity of 8.78 fps. The total volume of water would be approximately 15.3 acre-ft. It is proposed to build a 3-celled system with 2 gravel filter dikes and concrete grouted overflows. The upper 2 cells will act as filters for sediment removal, and the lower cell will become a settling basin for final cleaning prior to discharge. The pond discharge will be sampled per NPDES requirements to check for compliance with effluent standards.

It is expected that effluent standards will be met by this structure; similar filtering ponds have cleaned and discharged up to 1,000,000 gallons per day of sediment-laden mine water and remained in compliance.

The rationale for proposing such a filtering discharge system is based on the following:

- (1) The main purpose of sediment ponds or any other treatment facility is to control and minimize water pollution by causing the water to meet effluent standards; this type of system will accomplish this purpose:
  
- (2) According to UMC 817.41 (2): Acceptable practices to control and minimize water pollution include:
  - (i) Stabilizing the disturbed area through land shaping;
  - (ii) Diverting runoff;
  - (iii) Achieving vegetation standards;
  - (iv) Regulating channel velocity of water;
  - (v) Lining channels with rock or vegetation;
  - (vi) Mulching;
  - (vii) Selectively placing and sealing acid-forming and toxic-forming materials;
  - (viii) Designing mines to prevent gravity drainage of acid waters;
  - (ix) Sealing;
  - (x) Controlling subsidence; and
  - (xi) Preventing acid mine drainage.

The planned reclamation at this site will meet the above criteria;

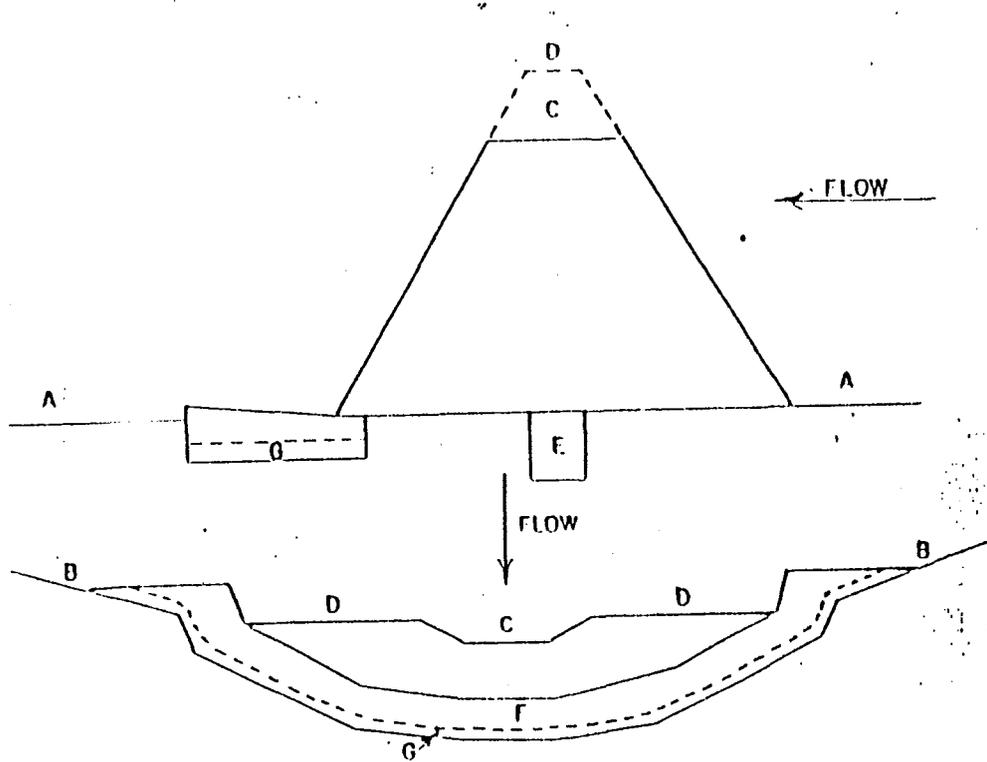
(3) According to UMC 817.42 (a)(1): "All surface drainage from the disturbed area, including areas that have been graded, seeded, or planted, shall be passed through a sedimentation pond, a series of sedimentation ponds, or a treatment facility before leaving the permit area."

The proposed pond will be equipped with a sediment marker, and cleaned as needed. The pond will also be fitted with a principal and emergency spillway adequately sized and protected to handle 10 year - 24 hour and 25 year - 24 hour events respectively.

When revegetation standards are met on the reclaimed site, the Pond "E-PM" will be removed, the main channel restored, and the area re-seeded according to the approved plan.



Figure



Notes:

1. A well-graded distribution of angular rock from 12-24 inches must be used. The angle of rest for this angular rock should correspond to a slope ratio not less than 1.5 to 1.0. The structure shall be 30 inches high. The angular rock shall be placed so as to form an 48-inch wide by 12-inch deep notch in the center of the basin to form a centralized spillway.
2. The keyway must be 24 inches wide and deep and excavated into the bed and banks. The keyway into the banks must be 36 inches deep.
3. The apron section must be 20 feet long and placed with an adverse slope of six inches over the 20-foot length. A filter blanket (3/8 inch minus material, six inches deep) must be placed under aprons. Riprap side slope protection measures for the length of the apron and two feet above the gabion crest must be included. The angle of rest for the 12-24 inch well-graded material used to construct the gabion must be strictly adhered to.

Construction Plans for a Loose-Rock Check Dam/Stilling Basin

1. Section of the dam parallel to the centerline of the gully.
2. Section of the dam at the cross section of the gully.  
 A = original gully bottom; B = original gully cross section;  
 C = spillway; D = crest of free board; E = excavation for key;  
 F = excavation for apron; G = filter blanket.

STILLING BASIN

#### 4.3.3 Pond Discharge Structures

Principle Spillways - These will consist of an 18" culvert, fitted with an inverted inlet to provide for oil skimming. The inlet will be approximately 1' below water level. The culvert will be located 3' below the top of the dam, and will discharge directly onto a rip-rapped channel leading to the main drainage. These spillways will provide for the normal dewatering of the pond at base capacity.

Emergency Spillways - The emergency spillway for proposed Pond E will be the open notch type with a trapezoidal cross section. The spillway dimensions will be as shown on the attached sheet. This will be located 12" above the principal spillway and 2' below the top of the dam. This structure will be rip-rapped through the point of discharge and into the main channel. This spillway will provide an added safety factor to protect the dam in the event of overload on the culvert discharge.

The emergency spillway for Pond C will consist of an open 36" culvert which empties directly into the main 42" culvert which drains the main canyon. This emergency spillway will be open at the top and will extend to within 2' of the top of the dam. At right angle to this emergency spillway culvert will be an 18" culvert to handle non-emergency overflow conditions. This 18" pipe will have an inverted inlet to skim oil and grease and flotsam from the water.

#### 4.3.4 Calculations

##### Source of Formulae

B.L.M. State Engineer

##### Rational Formula

$$QP = Cia$$

QP = Peak Discharge (C.f.s.)

C = Runoff Coefficient (@ 90% runoff, C = .9)

i = Rainfall intensity (in./hr.) for a 10 year - 24 hour storm  
in Price, i = .3024

a = Area (acres)

##### Manning Equation

$$D = \left[ \frac{(2.16Qn)}{\sqrt{s}} \right]^{.375}$$

D = Diameter (feet)

Q = QP = Peak Discharge (cfs)

n = Roughness factor (0.02 for steel culvert)

s = Slope (0.0556% = 1 foot for 18 feet)

##### Pond C (Principle Spillway)

1. QP = Cia; C=.9, i=.3024, a=10.96 acres

$$QP = (0.9) (0.3024) (10.96)$$

$$QP = 2.983 \text{ cfs}$$

2.  $D = \left[ \frac{(2.16Qn)}{\sqrt{s}} \right]^{.375}$ ; Q = 2.983, n = 0.02,  $\sqrt{s} = .2357$

$$D = \left[ \frac{(2.16)(2.983)(0.02)}{0.2357} \right]^{.375}$$

Req. D = .797 ft. = 9.57 inches

Actual D = 36 inches

## 4.4 Culverts

### General

Culverts will be sized as per the designations on the attached maps, and will be placed to drain on a minimum of .0556% slope (1 ft./18ft.). Each culvert will be fitted with a trash rack on the inlet to help prevent plugging from washed-in debris. Each culvert shall discharge onto a protected surface (i.e. rip-rap, conveyor belting, flexible downspouts, or other) to prevent scouring and erosion. The use of energy dissipators shall be employed as necessary to reduce velocities and prevent erosion from culvert discharges.

### Maintenance

Culverts shall be inspected regularly, and cleaned as necessary to provide for passage of designed flows. Inlets and outlets shall also be maintained so as to prevent plugging or undue restriction of water flow.

#### 4.4.1 CULVERT SIZE DETERMINATION

##### SOURCE:

"Applied Hydrology and Sedimentology for Disturbed Areas",  
Barfield, Warner and Haan, 1983.

##### PEAK FLOW - SCS-TR-55 METHOD FOR TYPE II STORMS:

$$qp = qp^1 AQ;$$

A = Watershed in square miles;

Q = Runoff volume in inches;

$qp^1$  = Discharge from Fig. 2.40

qp = Peak Discharge in cfs.

##### MANNING EQUATION

$$D = \left[ \frac{2.16Qn}{\sqrt{s}} \right]^{0.375}$$

D = Diameter (feet)

Q = QP = Peak discharge (cfs)

n = roughness factor (0.02 for steel culvert)

s = slope (0.0556% = 1 foot for 18 feet)

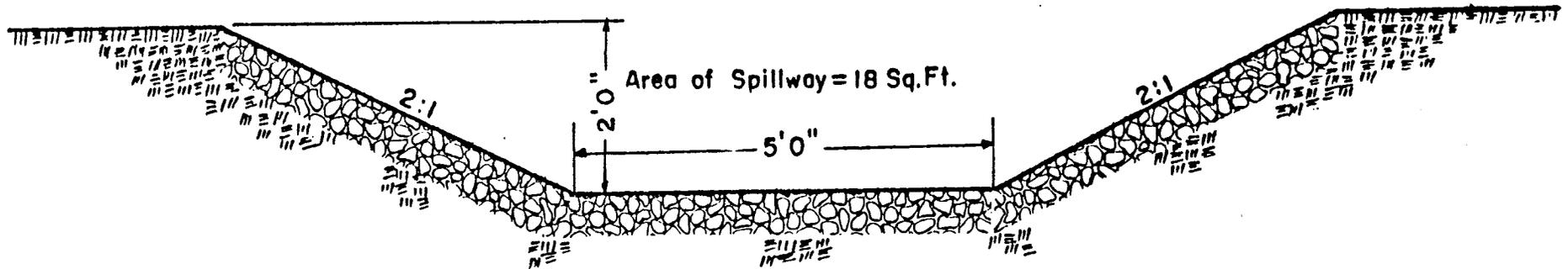
Using the above formulas minimum culvert sizes were calculated  
based on 100% runoff from a 10 year - 24 hour storm:

4.4.2 WATERSHED AND CULVERT SIZING MAP

<u>Culvert</u>	<u>Watershed Area (acres)</u>	<u>Culvert Needed (in.)</u>	<u>Culvert Used (in.)</u>
C1	466.07	25.3	30
C2	21.27	13.8	18
C3	487.34	26.9	36
C4	81.97	17.3	18
C5	569.31	30.6	36
C6	23.87	13.1	18
C7	593.18	31.6	36
* C8	51.06	18.4 *	18
C9	644.24	33.7	42
C10	17.84	12.7	18
C11	662.08	34.6	42
C12	56.20	15.2	18
C13	718.28	36.4	42
C14	21.31	13.3	18
C15	739.59	37.2	42

\* Adequate Headwater Available to allow flow.

ANDALEX RESOURCES, INC.  
Price, Utah  
Centennial Project



Typical Section of Emergency Spillways

Scale : 1" = 2'0"

Date : 8-20-81

## 4.5 Diversion Structures

### General

Diversion ditch locations are shown on the enclosed Surface Facilities Map and Drainage Map, Plate 8. The direction of flow is also shown. All diversions are classed as temporary, and will be removed upon final reclamation.

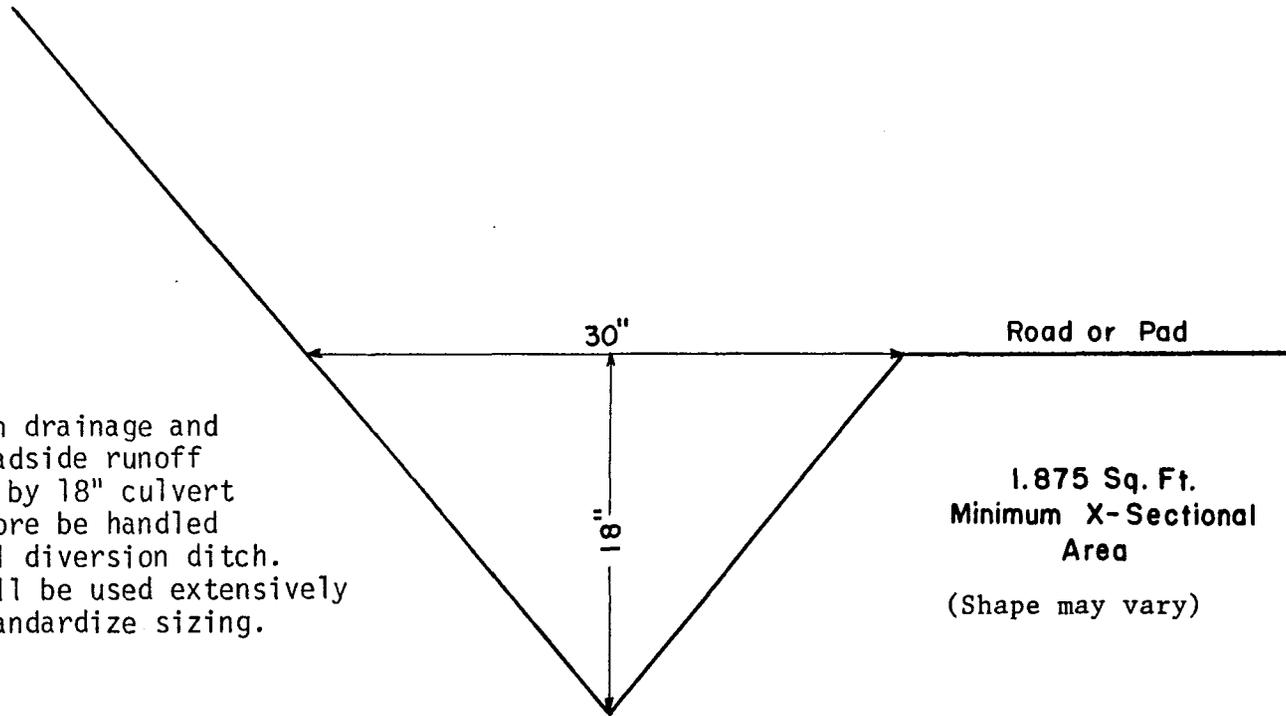
### Specifications

Diversions along the upslope side of the road will be as per specifications on the haul road design. At a minimum, these, and any other diversions shown, will meet the minimum size specifications on the attached Diversion Ditch Typical sheet. Diversions are sized to carry the runoff from a 10 year - 24 hour precipitation event in the area.

### Maintenance

All diversions will be maintained so as to pass the volumes of water for which they were designed. Sluffage will be cleaned out along with regular road maintenance procedures, and any blockage will be removed as soon as practicable after occurrence. Velocities will be controlled as needed to prevent excessive scouring.

# Centennial Project



Note: All side canyon drainage and all pad and roadside runoff can be handled by 18" culvert and can therefore be handled by this typical diversion ditch. 18" culvert will be used extensively in order to standardize sizing.

**1.875 Sq. Ft.  
Minimum X-Sectional  
Area**

(Shape may vary)

## Diversion Ditch Typical

Scale: 1" = 10"

Date: 8-20-81 J.B.

4.6 Comment 817.43 Hydrologic Balance:  
Diversions and Conveyance of Overland Flow-DC

Response:

There are 2 types of diversions at this property- undisturbed and disturbed. The undisturbed diversions are labeled UD-1, UD-2, and C-1 through C-15, and carry undisturbed drainage around and under the disturbed area. All undisturbed diversions are in place, and are shown on Plate 9, along with respective drainage areas. Cross sections of the undisturbed diversions are shown on the attached "Undisturbed Diversion Ditch Typical." Design calculations are shown on the attached tables entitled "Diversion Design", "Main Channel Culvert Design", and "Side Drainage Culvert Design".

The disturbed diversions carry disturbed drainage to the sediment ponds. The existing disturbed diversions are labeled DD-1, DD-2 and DD-3, are shown on Plate 6 "Support Facilities- As Constructed." The proposed diversion DD-4 are shown on Plate 7 "Support Facilities- As Proposed". Cross sections of the disturbed diversions are shown on the attached "Diversion Ditch Typical". Design calculations are shown on the attached table entitled "Diversion Design".

Peak flows for all undisturbed diversions were calculated by the SCS-TR55 Method for Type II storms, as described in "Applied Hydrology and Sedimentology for Disturbed Areas", by Barfield, Warner and Haan, 1983. The Rationale Method was used to calculate peak flows for small, disturbed area diversions, since it is more applicable to the extremely short times of concentration calculated for the pad and road areas.

A runoff curve number of 70 was used for undisturbed areas, and a CN of 90 was used for the disturbed area.

The outlet of C-15 (Main-Channel Culvert) shows a velocity of 7.28 fps, which could be slightly erosive in this area; however, existing boulders at this outlet range from 12 to 36 inches in diameter and function as an adequate energy dissipator and erosion control device. Based on past history of storms with little or no evidence of erosion at this point it is not felt necessary to install additional protection. Erosion protection parameters are shown on the attached "Erosion Protection" for reference only, to show that the existing natural rock is adequate size for erosion control.

The culvert outlet will be monitored after each major storm to ensure that erosion is not occurring. If erosion does become evident, protection will be installed according to the design on the table entitled "Erosion Protection".

Velocities on the undisturbed diversions UD-1 and UD-2 and the disturbed diversion DD-1 thru DD-4 are less than 6.5 fps, and are not considered erosive as shown in the Manning's N chart in Exhibit I attached. (Also see response to UMC 784.22 for justification of erosive velocities.)

4.7 Comment UMC 817.44:  
Stream Channel Diversions-DC

Response:

The reclamation plans for the drainage in the area consist of replacing each of the culverts C-1 through C-15 with restored channels. The undisturbed diversions UD-1 and UD-2 will also be removed and replaced with appropriate sized channels, corresponding to the channels at culverts C-4 and C-12 respectively. The restored channels are all sized to carry the runoff from a 100 year- 24 hour precipitation event. Cross sections of the restored channels are shown in the attached "Restored Channel Typical". Design calculations are summarized in the table entitled "Restored Channel Designs".

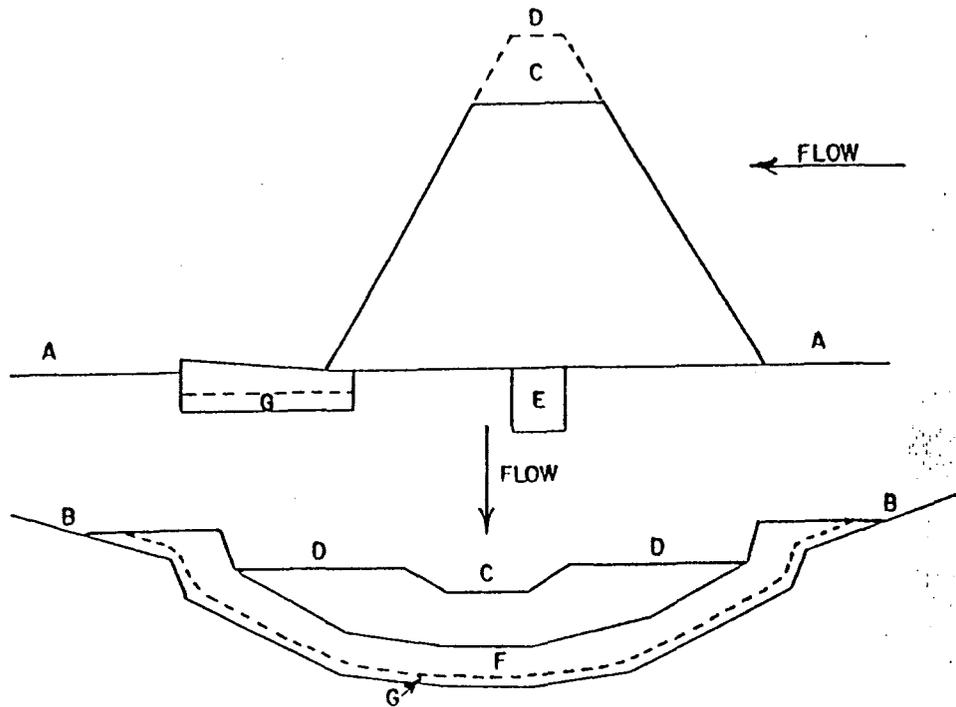
Culverts C-1, C-3, C-5, C-7, C-9, C-11, C-13, and C-15 will be replaced by the Main Channel RC-1, and culverts C-2, C-4, C-6, C-8, C-10, C-12, and C-14 will be replaced by the Side Channels entitled RC-2, RC-4,..... RC-14, respectively.

The only restored channels with erosive velocities for this area (greater than 6.5 fps) are RC-1, RC-4, and RC-12. Erosion protection is planned for these channels, as shown on the table entitled "Erosion Protection". All other restored channels are expected to have non-erosive velocities, and will not require erosion protection.

Loose Rocks Check Dams will be placed at the entrance of each side drainage onto the reclaimed area, and at approximately 500' intervals along the main restored channel, RC-1. See attached figure for a typical section of the loose rock check dams.

FIGURE

Notes:



1. A well-graded distribution of angular rock from 6-24 inches must be used. The angle of rest for this angular rock should correspond to a slope ratio not less than 1.5 to 1.0. The structure shall be 24-30 inches high. The angular rock shall be placed so as to form an 18-inch wide by 5-inch deep notch in the center of the creek channel to form a centralized spillway.
2. The keyway must be 24 inches wide and deep and excavated into the streambed and banks. The keyway into the banks must be 36 inches deep.
3. The apron section must be 10 feet long and placed with an adverse slope of six inches over the 10 feet length. A filter blanket (3 inch minus material, six inches deep) must be placed under aprons. Riprap side slope protection measures for the length of the apron and two feet above the gabion crest must be included. The angle of rest for the 6-24 inch well-graded material used to construct the gabion must be strictly adhered to.

Construction Plans for a Loose-Rock Check Dam

1. Section of the dam parallel to the centerline of the gully.
2. Section of the dam at the cross section of the gully;  
A = original gully bottom; B = original gully cross section;  
C = spillway; D = crest of free board; E = excavation for key;  
F = excavation for apron; G = filter blanket.

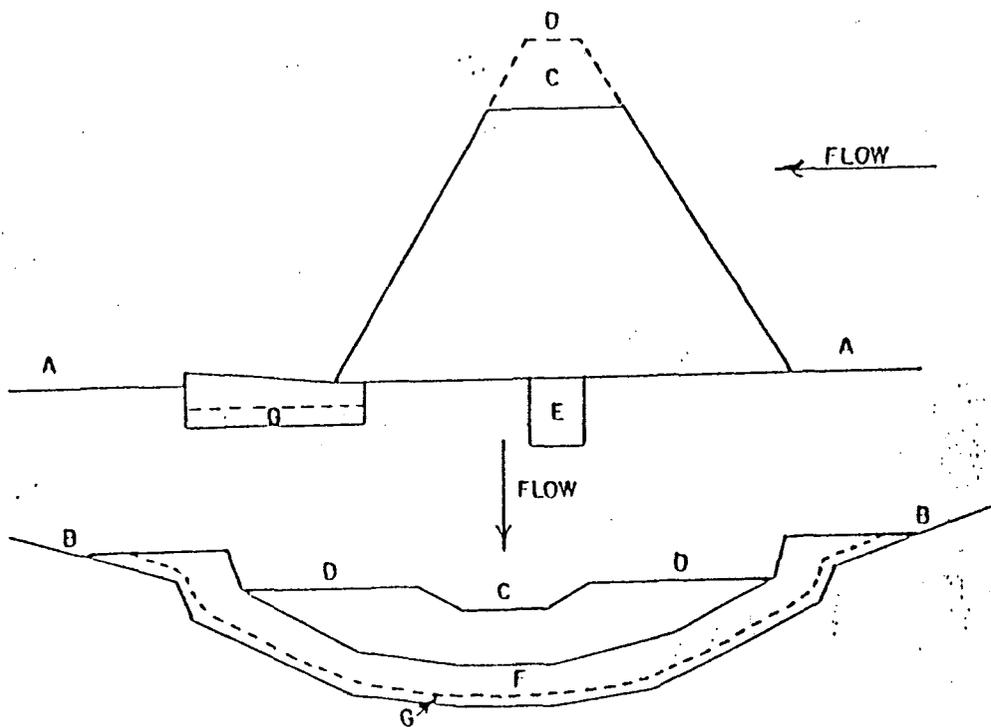
**LOOSE-ROCK CHECK DAM**

(RESTORED SIDE DRAINAGE CHANNELS)

FIGURE

Notes:

1. A well-graded distribution of angular rock from 6-24 inches must be used. The angle of rest for this angular rock should correspond to a slope ratio not less than 1.5 to 1.0. The structure shall be 24-30 inches high. The angular rock shall be placed so as to form an 36-inch wide by 6-inch deep notch in the center of the creek channel to form a centralized spillway.
2. The keyway must be 24 inches wide and deep and excavated into the streambed and banks. The keyway into the banks must be 36 inches deep.
3. The apron section must be 15 feet long and placed with an adverse slope of six inches over the 15-foot length. A filter blanket (33 inch minus material, six inches deep) must be placed under aprons. Riprap side slope protection measures for the length of the apron and two feet above the gabion crest must be included. The angle of rest for the 6-24 inch well-graded material used to construct the gabion must be strictly adhered to.



Construction Plans for a Loose-Rock Check Dam

1. Section of the dam parallel to the centerline of the gully.
  2. Section of the dam at the cross section of the gully.
- A = original gully bottom; B = original gully cross section;  
 C = spillway; D = crest of free board; E = excavation for key;  
 F = excavation for apron; G = filter blanket.

LOOSE ROCK CHECK DAM

(RESTORED MAIN DRAINAGE CHANNEL)

4.8 Comment UMC 817.46 Hydrologic Balance:  
Sedimentation Ponds-JRH and DC

Response:

The sedimentation ponds are shown on Plates 12 and 13. Pond C is constructed as shown on Plate 6 - "Support Facilities - As Constructed". There will be no Pond D. Pond E (Plate 13) is a proposed pond, as shown on Plate 7- "Support Facilities- As Proposed". The plans and profiles shown on Plate 12 are for Pond C, as- constructed. Plate 13 (Pond E) is a design plate only.

All elevations of inflow and discharge are shown on the plates. Also, the embankment slopes are shown not to exceed 5:1 as required. The embankment widths are greater than the required width of "height of embankment plus 35 feet divided by 5' as required. (Please note the different horizontal and vertical scales used on the section views of the ponds.)

Previous pond "B" has been redesignated as "Primary Settling Basins" since all the runoff from the basins reports to Sediment Pond "C" (See Plate 11).

Sediment Pond "C"

Design specifications for Sediment Pond "C" are shown in Section 4.3.1 of this submittal. All concerns are addressed in this section and on Plate 12.

Sediment Pond "E"

Design specifications for Sediment Pond "E" are covered under Section 4.3.2 of this submittal. All concerns are addressed in this section and on Plate 13.

4.9 Comment UMC 817.47 Hydrologic Balance:  
Discharge Structures-DC

Response:

Discharge structures from the sediment ponds have been included in the response to UMC 817.46.

4.10 Comment UMC 817.48 Hydrologic Balance:  
Acid-Forming and Toxic Forming Material-JSL

Response:

Please refer to the following pages for additional data on Acid and Toxic forming materials.

4.11 Comment UMC 817.49 Hydrologic Balance:  
Permanent and Temporary Impoundments-DC

Response:

The sedimentation pond E will remain in place after reclamation, until adequate revegetation is established on the reseeded areas. At this time, the pond will be removed and reclaimed according to UMC 817.46 (U).

4.12 Comment 817.52 Hydrologic Balance:  
Surface and Ground Water Monitoring - DC

Response:

The updated surface and groundwater monitoring data is included in Section 3.3-1.3.

4.13 Comment 817.55 Hydrologic Balance:  
Discharge of Water into an Underground Mine - KRW

Response:

The Drainage Map, Plate 8, delineates various drainage areas on the site. Based on planimeter areas from this map, the following areas are drained into the respective mines:

<u>Mine</u>	<u>Disturbed (ac.)</u>	<u>Undisturbed (a.c)</u>
Pinnacle Mine	1.78	1.40
Apex	1.06	-
Old Chidester Mine	6.20	11.65

The water flowing into the mines is strictly from surface runoff, and the quantity is thus highly variable. Because this is such a dry canyon, it is necessary to capture as much water as possible to allow for underground mining operations. The water is directed into storage sumps in the mine, where it is settled and used for dust suppression. No water is discharged from the mines, and any water going into the mine is used in sprays or remains in the sumps.

Andalex owns the rights to this water.

DIVERSION DESIGN

<u>Structure</u>	<u>UD-1</u>	<u>UD-2</u>	* <u>DD-1</u>	* <u>DD-2</u>	* <u>DD-3</u>	* <u>DD-4</u>
Drainage Area (acres)	87.78	74.20	0.735	3.72	10.5	6.02
10 yr. - 24 hr. Event (in)	1.82	1.82	1.82	1.82	1.82	1.82
Time of Conc. (hrs.)	0.24	0.21	0.04	0.04	0.04	0.04
Curve number	70	70	90	90	90	90
Manning's Number	.038	.040	.040	.040	.040	.040
Ditch Slope (%)	6.75	8.33	6.25	6.25	6.25	6.25
Peak Flow	20.57	18.32	0.22	1.13	2.86	1.64
Min. Structure Area (ft <sup>2</sup> )	6.25	6.25	1.875	1.875	1.875	1.875
Req'd Area (ft <sup>2</sup> )	3.38	3.10	0.06	0.28	0.72	0.41
Depth of Flow (ft)	1.35	1.24	0.03	0.15	0.58	0.33
Velocity (fps)	6.08	5.92	3.97	3.97	3.97	3.97
Hydraulic Length	2850'	2800'	200	200	200	200
Land Slope (%)	47.22	58.33	6.25	6.25	6.25	6.25

\*Rationale Method Used

q=CiA; q=peak flow in cfs

c=.9 (90% runoff); i=0.3024 in/hr. for Price, Utah

A=Drainage Area

Note: The Rationale Method was used to calculate peak flows for small, disturbed areas, since it is more applicable to extremely short times of concentration such as those experienced on the pads and road areas.

MAIN CHANNEL CULVERT DESIGN

<u>Structure</u>	<u>C1</u>	<u>C3</u>	<u>C5</u>	<u>C7</u>	<u>C9</u>	<u>C11</u>	<u>C13</u>	<u>C15</u>
Drainage Area	466.07	487.34	569.31	593.18	644.24	662.08	718.28	739.59
10 yr. - 24 hr. Event	1.82	1.82	1.82	1.82	1.82	1.82	1.82	1.82
Time of Conc. (hrs.)	1.02	-	-	-	-	-	-	-
Curve number	70	70	70	70	70	70	70	70
Manning's number	0.025	0.025	0.025	0.025	0.025	0.025	0.025	0.025
Ditch Slope (%)	5.56	5.56	5.56	5.56	5.56	5.56	5.56	5.56
Peak Flow	40.05	46.70	65.91	71.69	86.05	91.40	105.10	111.26
Min. Structure Area (ft <sup>2</sup> )	4.91	7.07	7.07	7.07	9.62	9.62	9.62	9.62
Velocity (fps)	7.28	7.28	7.28	7.28	7.28	7.28	7.28	7.28
Hydraulic Length	10,200	-	-	-	-	-	-	-
Land Slope	19.83	-	-	-	-	-	-	-
Headwater Req'd (ft)	4.00	N/A	-	-	-	-	-	-
D Req'd (ft)	2.11	2.24	2.55	2.63	2.81	2.88	3.03	3.10

SIDE DRAINAGE CULVERT DESIGN

<u>Structure</u>	<u>C-2</u>	<u>C-4</u>	<u>C-6</u>	<u>C-8</u>	<u>C-10</u>	<u>C-12</u>	<u>C-14</u>
Drainage Area	21.27	81.97	23.87	51.06	17.84	56.20	21.31
10 yr. - 24 hr. Event	1.82	1.82	1.82	1.82	1.82	1.82	1.82
Time of Conc. (hrs.)	0.08	0.24	0.22	0.14	0.11	0.21	0.13
Curve Number	70	70	70	70	70	70	70
Manning's Number	0.025	0.025	0.025	0.025	0.025	0.025	0.025
Ditch Slope (%)	4.00	10.00	4.00	4.00	4.00	10.00	4.00
Peak Flow	6.65	19.21	5.78	14.36	5.35	13.70	6.16
Min. Structure Area (ft <sup>2</sup> )	1.767	1.767	1.767	1.767	1.767	1.767	1.767
Velocity (fps)	6.18	8.73	6.18	6.18	6.18	9.77	6.18
Hydraulic Length	850	2850	1400	1600	1250	2800	1300
Land Slope	61.54	47.22	56.67	58.62	63.16	58.33	46.82
Headwater Req'd (ft)	1.11	* 3.30	1.02	* 2.80	0.98	* 2.90	1.08
D Req'd. (ft)	1.15	* 1.44	1.09	* 1.53	1.06	* 1.27	1.11
D In Place (ft)	1.5	1.5	1.5	1.5	1.5	1.5	1.5

\* Available headwater at culvert inlet is greater than that required to allow for surge storage and passage of flows.

RESTORED CHANNEL DESIGNS

<u>Structure</u>	<u>Main Channel RC-1</u>	<u>Side Channel RC-2</u>	<u>RC-4</u>	<u>RC-6</u>	<u>RC-8</u>	<u>RC-10</u>	<u>RC-12</u>	<u>RC-14</u>
Drainage Area	805.50	25.71	87.78	40.04	53.63	29.38	74.20	27.18
100 yr. - 24 hr. Event	2.74	2.74	2.74	2.74	2.74	2.74	2.74	2.74
Time of Conc. (hrs.)	1.02	0.08	0.24	0.22	0.14	0.11	0.21	0.13
Curve number	70	70	70	70	70	70	70	70
Manning's Number	0.040	0.040	0.040	0.040	0.040	0.040	0.040	0.040
Ditch Slope (%)	5.56	4.00	10.00	4.00	4.00	4.00	10.00	4.00
Peak Flow	193.82	22.09	54.69	26.50	41.48	23.99	49.74	21.61
Min. Structure Area (ft <sup>2</sup> )	27.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
Req'd Area (ft <sup>2</sup> )	22.08	4.23	6.65	5.09	7.96	4.60	6.04	4.15
Depth of Flow (ft)	2.45	1.05	1.66	1.27	1.99	1.15	1.51	1.04
Velocity (fps)	8.78	5.21	8.23	5.21	5.21	5.21	8.23	5.21
Hydraulic Length	10,200	850	2,850	1,400	1,600	1,250	2,800	1,300
Land Slope (%)	19.83	61.54	47.22	56.67	58.62	63.16	58.33	46.82
Erosion Protection (Y/N)	Y	N	Y	N	N	N	Y	N

EROSION PROTECTION

<u>Structure</u>	* Main Channel <u>C-15</u>	Restored Main Channel <u>RC-1</u>	Restored Side Channel <u>RC-4</u>	Restored Side Channel <u>RC-12</u>
Flow (cfs)		193.82	54.69	49.74
Slope (%)	5.56	5.56	10.00	10.00
Velocity (fps)	7.28	8.78	8.23	8.23
Rip-rap Size (M.D.)	9"	15"	12"	12"
Bedding (3/4" gravel)	9"	15"	12"	12"
Length of Protection (ft)	20'	All	All	All
Width of Protection (ft)	10'	12'	6'	6'

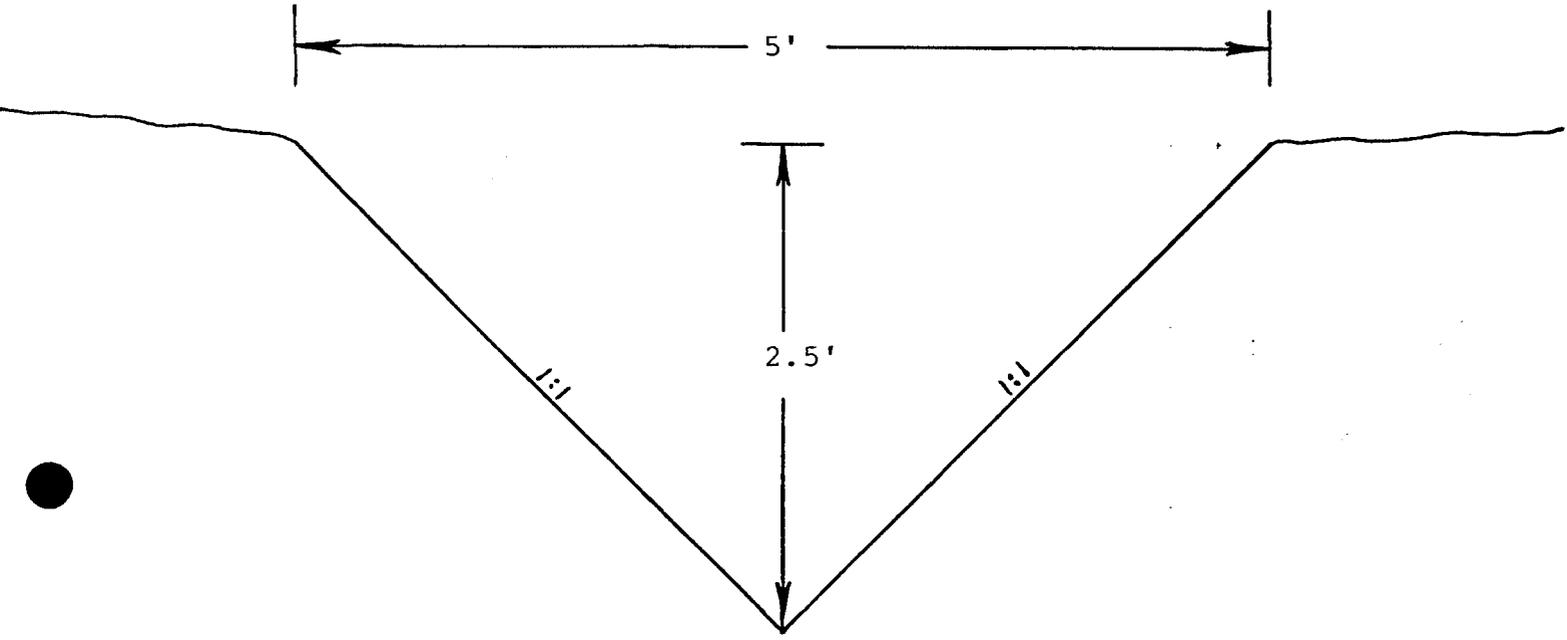
Reference: Attached Exhibit 1.

\* For Reference Only. Natural Rip-rap is more than adequate for erosion protection.

BY D. Guy DATE 3/15/87  
CHKD. BY DATE

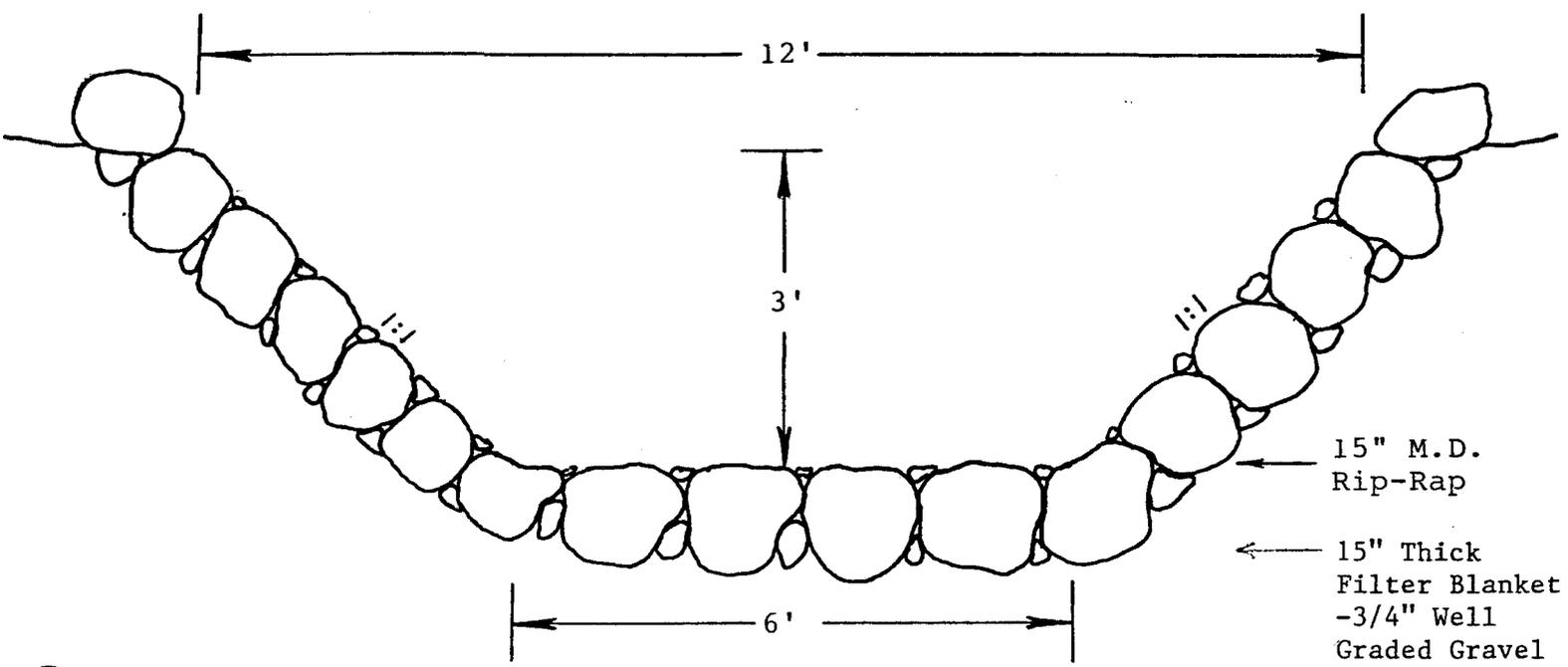
SUBJECT UNDISTURBED  
DIVERSION TYPICAL  
Scale: 1"=1'

SHEET NO. OF  
JOB NO.

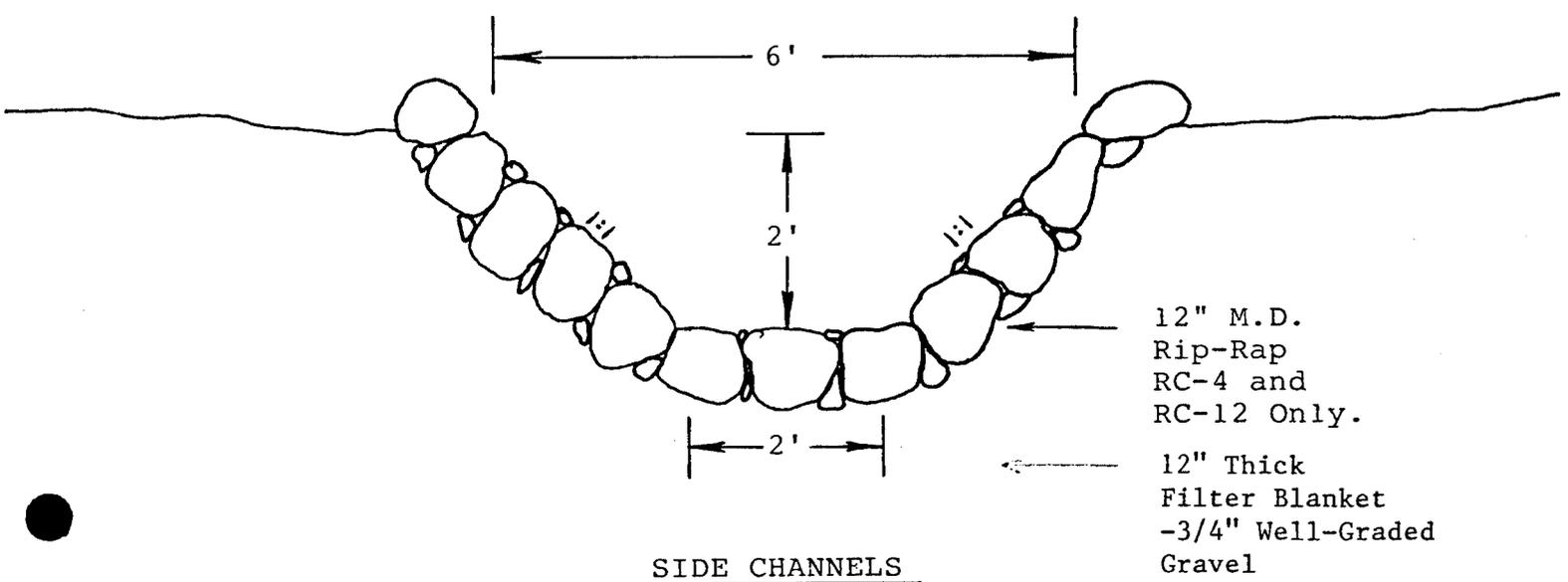


SECTION VIEW

Note: Ditch configuration may vary; however, minimum area will be maintained at 6.25 sq. ft.



MAIN CHANNEL - RC-1



SIDE CHANNELS

5.

Exhibit 1

Erosion Protection Charts

# Manning's N-VALUES

Table IV.C.1—Values for Manning's n and maximum permissible velocity of flow in open channels

Ditch lining		Manning's n	V <sub>max</sub> fps <sup>1</sup>		
1. Natural earth					
a. Without vegetation					
(1) Rock					
(a) Smooth and uniform		0.035 - 0.040	20		
(b) Jagged & Irregular		0.040 - 0.045	15 - 18		
(2) Soils					
Coarse grained	Gravel and gravelly soils	< Unified GW < USDA Gravel >	0.022 - 0.024	6 - 7	
		< GP < Gravel >	0.023 - 0.026	7 - 8	
		d	0.023 - 0.025	3 - 5	
		GM Loamy Gravel	u	0.022 - 0.020	2 - 4
		GC < Gravelly Loam Gravelly Clay >	< 0.024 - 0.026 >	5 - 7	
	Sand and sandy soils	SW Sand	0.020 - 0.024	1 - 2	
		SP Sand	0.022 - 0.024	1 - 2	
		d	0.020 - 0.023	2 - 3	
		SM Loamy Sand	u	0.021 - 0.023	2 - 3
		SC Sandy Loam	0.023 - 0.025	3 - 4	
Fine grained	50	CL Clay Loam Sandy Clay Loam Silty Clay	0.022 - 0.024	2 - 3	
		LL	ML Silt Loam Very Fine Sand Silt	0.023 - 0.024	3 - 4
	50	OL Mucky Loam	0.022 - 0.024	2 - 3	
		CH Clay	0.022 - 0.023	2 - 3	
		MH Silty Clay	0.023 - 0.024	3 - 5	
	LL	OH Mucky Clay	0.022 - 0.024	2 - 3	
	Highly Organic	PT Peat	0.022 - 0.025	2 - 3	

<sup>1</sup>Maximum recommended velocities.

2.4

A filter layer under all riprap is essential (3) unless the bank material meets the filter requirements. (See section 2.7.)

(1) Dumped riprap is graded stone dumped on a prepared slope in such a manner that segregation will not take place. Dumped stone riprap is the most flexible of the types considered here and will adjust itself to uneven bank settlement. In most areas dumped stone is the least costly type.

(2) Hand-placed riprap is stone laid carefully by hand or by derrick following a more or less definite pattern with the voids between the larger stone filled with smaller stone and the surface kept relatively even. The resulting protection approaches good dry rubble in quality and appearance, but this type of riprap is rigid and lacks the strength necessary to bridge even minor movement of the surface which it protects.

(3) Wire-enclosed riprap is stone placed in wire baskets or in wire covered mats. Wire-enclosed riprap is generally used because rock of suitable size is not available. This riprap is effective until the wire enclosure fails.

(4) Grouted riprap is riprap with the interstices filled with portland cement mortar. The use of grouted riprap is seldom justifiable when stone of suitable size is available.

(5) Concrete riprap in bags is concrete in cement sacks or suitable burlap bags that are hand placed in contact with adjacent bags.

(6) Concrete-slab riprap is plain or reinforced concrete slabs poured or placed on the surface to be protected. The slabs poured or placed on the surface to be protected. The slabs are not connected to each other.

## II - DESIGN

### 2.1 - Design of Dumped-Stone Riprap

The resistance of dumped stone to displacement by moving water depends upon:

- (1) Weight, size, shape, and composition of the individual stones
- (2) The gradation of the stone
- (3) The depth of water over the stone blanket
- (4) The steepness and stability of the protected slope
- (5) The stability and effectiveness of the filter blanket on which the stone is placed.

(6) The velocity of the flowing water against the stone

(7) The protection of toe and terminals of the stone blanket

The design of a dumped-stone blanket for bank protection is similar to that for a stone-lined channel discussed in section 4.12 of reference 8. The principal difference between stone linings and stone bank protection is that in linings the channel bed is also lined, and the lining is generally continuous throughout the length of channel wherein erosion is imminent. Bank protection is generally limited to problem areas. The toe and terminals of the bank protection are particularly vulnerable to attack by the current. At some locations, wave action may present a more severe form of attack than water flowing parallel to the embankment; such cases may require heavier protection. Protection from wave action is discussed in references 1, 4, 6, and 7.

### 2.1.1 - Size of Stone

The size of stone needed to protect a streambank or highway embankment from erosion by a current moving parallel to the embankment is determined by the use of figures 1 and 2. Size ( $k$ ) is the diameter, in feet, of a spherical stone that would have the same weight as the 50 percent size of stone. The size of stone is found by a trial-and-error procedure which consists of first estimating a stone size.

The mean velocity ( $V_m$ ) of the stream during the design flood must then be converted to velocity against the stone by use of figure 1. The ratio ( $\frac{k}{d}$ ) of the equivalent spherical diameter of the 50 percent stone size to the depth of flow during the design flood is computed by using 0.4 of the total depth when the depth of flow exceeds about 10 feet. The reason for this is that use of the total depth would result in a stone size which would be adequate at the total depth but which might be too light to provide protection near the water surface.

With the velocity against the stone ( $V_g$ ) enter figure 2 and read the stone size for the embankment slope. The stone size from figure 2 is the 50 percent (median) size, by weight, of a well-graded mass of stone with a unit weight of 165 pounds per cubic foot. If the stone size from figure 2 agrees with the assumed stone size, this is the correct size. If not, the procedure is repeated until the assumed size is in reasonable agreement with the size from figure 2.

When the unit weight of the stone is other than 165 pounds per cubic foot, the size from figure 2 should be corrected by Creager's equation (discussion of in reference 4):

$$k_w = \frac{102.5 k}{w - 62.5}$$

where  $k$  = stone size from figure 2

$k_w$  = stone size for stone of  $w$  pounds per cubic feet

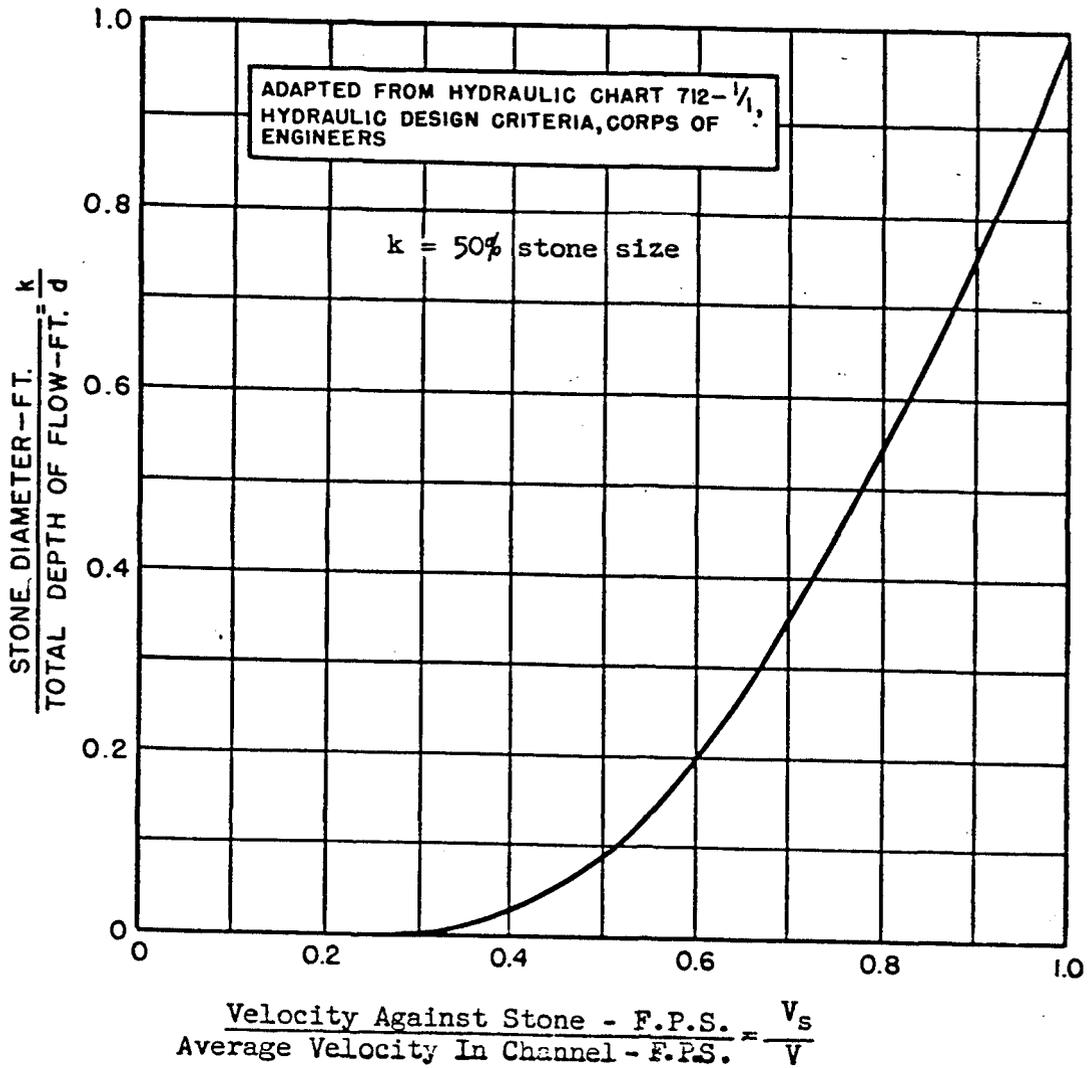


FIG. 1 - VELOCITY AGAINST STONE ON CHANNEL BOTTOM

The size of stone required to resist displacement from direct impingement of the current as might occur with a sharp change in stream alignment is greater than the value obtained from figure 2, although research data is lacking on just how much larger the stone should be. The California Division of Highways (6) recommends doubling the velocity against the stone as determined for straight alignment before entering figure 2 for stone size. Lane (9) recommends reducing the allowable velocity by 22 percent for very sinuous channels; for determining stone size by figure 2, the velocity ( $V_s$ ) would be increased by 22 percent. Until data are available for determining the stone size at the point of impingement, a factor which would vary from 1 to 2 depending upon the severity of the attack by the current, should be applied to the velocity  $V_s$  before entering figure 2.

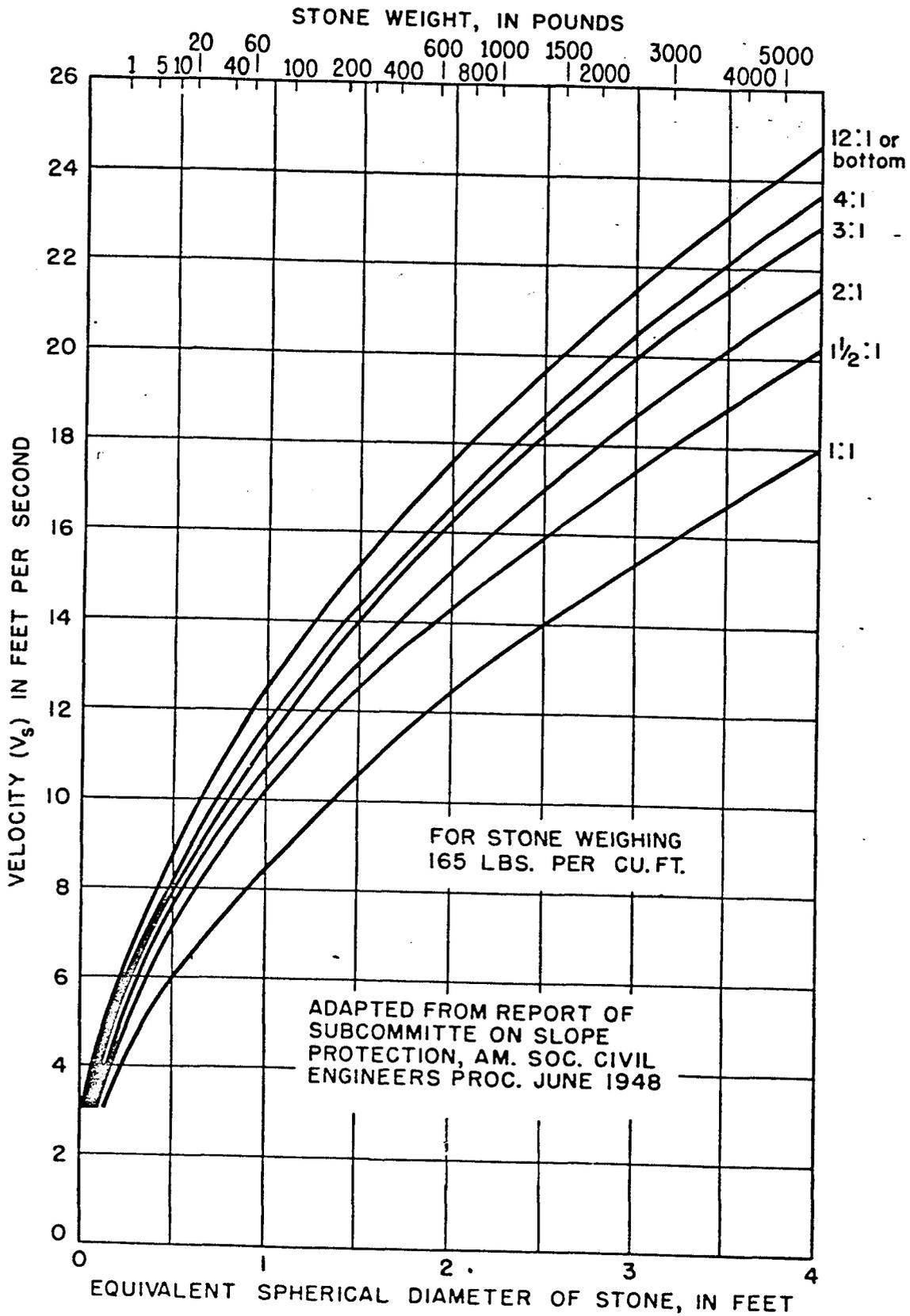


FIG. 2-SIZE OF STONE THAT WILL RESIST DISPLACEMENT FOR VARIOUS VELOCITIES AND SIDE SLOPES

## C. Climatological Information

### 1. Introduction

The permit area, which is part of the Book Cliffs coal field, is located in a mid-latitude steppe climate with the land below the cliffs approaching desert conditions. The nearest weather recording station is located approximately 10 miles southwest of the Zion's fee in Price, Utah.

Temperatures at the site are 3 to 5°F cooler than at Price, 10 miles south and 1,200 feet lower. Average monthly temperatures at Price range from 25°F in January to 70-75° in July and August. Extreme temperatures of record are -31° and 108°F. Due to the elevation, and a predominance of clear skies and dry air, daily temperature ranges are rather large, averaging 26 degrees in winter and 33 degrees in summer. Average annual precipitation is 12 inches at the portal and may be as much as 16 inches at the higher parts of the lease area. The 100-year 6-hour precipitation is about 2 inches. Snowfall is generally light, averaging less than 33 inches annually, at Price. Potential evaporation is about 36 inches per year. The area is almost completely surrounded by mountains which act as a barrier to storms approaching from every direction except south.

### 2. Source of Data

National Oceanic and Atmospheric Administration, National Climatic Center, Asheville, North Carolina.

Department of the Interior, 1979. Final Environmental Statement, Development of Coal Resources in Central Utah.

### 3. Climatological Factors

#### 3.1 Precipitation

The precipitation in the area, which is largely controlled by elevation, varies from five inches to 20 inches.

The principal rainfall is in late summer when the area is occasionally subjected to thunderstorm activity associated with moisture-laden air masses moving in from the Gulf of Mexico.

Snowfall is generally light, averaging less than 33 inches annually; however, as much as 95 inches have been reported in a single winter season.

The greatest and least monthly precipitation totals for the period of record are shown below in Table IV-1.

TABLE IV-4

## Maximum and Minimum Monthly Precipitation

<u>Month</u>	<u>Medium</u>	<u>Greatest</u>	<u>Year</u>	<u>Least</u>	<u>Year</u>
January	0.60	2.50	1969	0	1948
February	0.61	2.44	1919	0	1967
March	0.83	2.58	1912	0	1934
April	0.47	2.22	1941	0	1948
May	0.46	2.19	1964	0	1927
June	0.54	3.69	1927	0	1950
July	0.73	3.84	1914	0.05	1963
August	1.05	4.32	1921	0	1911
September	0.60	5.91	1927	0	1934
October	0.90	4.34	1972	0	1952
November	0.38	2.84	1957	0	1932
December	0.60	2.86	1966	0	1930
Annual	9.47	19.55	1927	4.47	1942

The first column contains median precipitation values by month for the 30 year period from 1936-1965.

Extremes of precipitation occurring prior to 1936 are as follows:

<u>Amount</u>	<u>Date</u>
0.83	January, 1921
0.98	March, 1929
2.00	August, 1921
1.65	October, 1925

TABLE IV-5

ESTIMATED RETURN PERIODS FOR SHORT DURATION PRECIPITATION  
(inches)

Station: Price  
Latitude: 39° 37'

Elevation: 5680  
Longitude: 110° 50'

D U R A T I O N

<u>R E T U R N</u> <u>P E R I O D</u> (Years)	<u>D U R A T I O N</u>									
	5 Min	10 Min	15 Min	30 Min	1 Hr	2 Hr	3 Hr	6 Hr	12 Hr	24 Hr
1	.08	.13	.17	.23	.29	.37	.44	.62	.78	.95
2	.12	.18	.23	.32	.40	.49	.58	.80	1.00	1.20
5	.16	.25	.32	.44	.56	.68	.79	1.07	1.32	1.58
10	.20	.31	.39	.54	.68	.81	.94	1.25	1.53	1.82
25	.24	.37	.47	.65	.82	.98	1.13	1.50	1.83	2.18
50	.28	.43	.54	.75	.95	1.12	1.29	1.71	2.08	2.47
100	.31	.49	.62	.85	1.08	1.27	1.45	1.91	2.32	2.74

Table IV-6 shows the average monthly precipitation for the period 1936-1976.

The climatology summary by month for period 1936-1965 is given in Table IV-7.

Total Precipitation (Inches)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Ann'l
1936	0.51	1.21	0.54	0.15	0.20	0.55	2.73	1.72	0.70	1.00	0.05	2.08	11.44
1937	1.37	1.08	0.96	0.08	1.45	0.68	1.11	0.68	1.15	0.44	0.08	0.95	10.03
1938	0.56	0.39	1.81	0.13	1.12	1.22	0.91	1.05	1.57	1.53	0.20	0.58	11.07
1939	1.03	1.00	1.24	0.48	0.68	0.25	0.44	0.87	3.88	0.89	0.15	0.25	11.16
1940	1.77	1.40	0.15	0.57	0.21	0.50	0.10	1.12	4.39	0.76	0.32	0.83	12.12
1941	0.92	1.04	1.23	2.22	1.26	1.47	0.75	0.57	1.02	3.24	0.73	1.03	15.48
1942	0.16	0.23	0.43	0.72	0.04	0.00	0.33	0.59	0.40	1.14	0.25	0.18	4.47
1943	0.37	0.45	0.90	0.55	0.40	1.40	0.19	1.05	0.95	1.04	1.16	0.30	8.76
1944	1.38	0.62	1.29	1.86	0.80	1.10	0.35	0.30	0.02	0.31	0.56	0.18	8.77
1945	0.41	1.17	0.91	0.21	0.13	1.28	0.69	0.82	0.51	0.94	0.32	0.57	7.96
1946	0.44	T	1.04	0.23	0.24	0.02	0.38	1.06	0.05	1.76	1.45	0.92	7.59
1947	0.13	0.12	0.19	0.37	1.34	0.70	0.14	2.83	0.07	0.90	0.41	0.93	8.13
1948	0.00	0.59	0.40	0.00	0.07	1.41	0.90	0.66	0.22	1.58	0.09	1.55	7.47
1949	1.60	0.74	0.11	0.22	1.66	3.24	1.89	1.22	0.66	1.73	0.01	2.35	15.43
1950	0.92	0.27	0.37	0.08	0.14	0.00	1.98	0.11	0.70	T	0.56	0.49	5.62
1951	0.03	0.07	0.74	1.08	0.88	1.89	0.26	1.85	0.16	0.98	1.22	2.80	11.26
1952	1.09	0.17	1.97	0.81	0.79	1.06	0.27	1.59	0.37	0.00	0.21	1.58	9.91
1953	0.43	0.12	0.24	0.45	0.42	0.15	1.67	1.12	0.04	1.39	0.43	0.17	6.63
1954	0.76	T	0.80	0.57	0.35	0.52	1.80	0.92	2.38	0.79	0.49	0.62	10.00
1955	1.06	1.40	0.09	0.05	0.39	0.38	0.30	1.52	0.31	0.01	0.17	0.38	6.06
1956	1.44	0.15	0.00	0.35	0.44	T	0.69	0.42	0.15	0.50	0.00	0.19	4.33
1957	0.87	0.63	0.40	0.65	1.86	1.20	1.07	2.30	T	1.86	2.84	0.98	14.66
1958	0.10	1.17	2.12	0.81	1.19	0.12	0.10	0.83	1.41	0.22	0.43	0.06	8.56
1959	0.06	1.57	0.12	0.59	0.66	0.25	0.75	2.09	1.18	0.45	0.17	1.04	8.93
1960	0.98	1.20	-	0.51	0.40	0.31	0.54	0.23	1.35	2.93	0.67	0.00	-
1961	0.00	0.03	1.02	0.23	0.11	0.08	0.76	2.43	4.85	1.06	0.88	0.82	12.27
1962	0.92	2.36	0.58	0.13	0.23	0.26	0.70	0.00	2.07	1.05	0.03	0.05	8.38
1963	0.68	0.32	0.73	1.50	0.12	0.58	0.05	3.33	1.89	0.76	0.18	0.02	10.16
1964	0.12	0.06	1.06	1.05	2.19	0.76	-	1.26	0.33	0.01	0.69	2.29	-
1965	0.32	-	1.28	-	-	3.31	1.79	1.24	0.98	0.32	2.06	2.47	-

TABLE IV-6

TABLE IV-6

## Total Precipitation (Inches)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Annl
1966	.00	.87	.12	.00	.57	.32	1.16	1.25	.50	1.14	.14	2.86	8.93
1967	1.06	.00	.29	.65	1.40	1.42	.84	.66	1.14	.08	.19	2.01	9.74
1968	.48	1.11	1.04	1.41	1.03	-----	.79	1.82	.29	.49	T	.96	-----
1969	2.50	1.37	.24	.28	.37	2.41	1.46	1.83	.59	.38	.33	.10	11.86
1970	.77	.01	.48	.12	.03	2.11	.65	.82	1.03	.56	.38	.38	7.34
1971	.22	.35	.03	.61	.80	.17	.68	.89	.24	3.26	.22	1.51	8.98
1972	.00	.00	.00	.19	.21	.66	.33	.91	1.33	4.34	.83	.68	9.48
1973	.62	.41	1.51	.84	1.15	1.40	1.97	1.17	.21	.56	.42	.36	10.62
1974	.81	.10	.07	.56	T	.04	2.12	.35	.21	4.08	.22	.53	9.09
1975	.76	.69	1.11	T	.74	.92	1.54	.06	1.26	.14	.45	.08	7.75
1976	T	1.16	.20	.91	.77	.13	.39	.30	1.62	.37	.03	.00	5.88

Source: National Oceanic and Atmospheric Administration,  
National Climatic Center,  
Asheville, North Carolina

Table IV-7

## Climatological Summary

Means and Extremes for Period 1936 - 1965

Month	Temperature (°F)							Precipitation Totals (Inches)								Mean Number of days				
	Means			Extremes				Mean	Greatest Daily	Year	Snow, Sleet					Precip. + .1"	Temperatures			
	Daily Maximum	Daily Minimum	Monthly	Record Highest	Year	Record Lowest	Year				Mean	Maximum Monthly	Year	Greatest Daily	Year		Max.		Min.	
								90° and above	32° and below	32° and below						0° and below				
Jan.	37.1	11.0	24.1	58	1961	-29	1937	.68	.67	1956	9.2	21.5	1944	8.5	1956	2	0	8	31	4
Feb.	42.3	17.4	29.8	68	1958	-17	1963	.68	.80	1962	7.0	27.0	1939	13.0	1939	2	0	4	27	3
Mar.	51.6	25.2	38.4	75	1956	-7	1964	.78	.97	1938	3.9	26.0	1952	6.0	1963	3	0	-	27	-
Apr.	63.8	34.2	49.0	86	1946	8	1945	.57	.66	1944	0.1	2.0	1944	2.0	1944	2	0	0	12	0
May	74.1	42.9	58.5	94	1962	20	1959	.68	1.45	1937	0.4	10.0	1964	8.0	1964	2	1	0	2	0
June	83.6	50.0	66.9	101	1954	29	1939	.80	1.47	1941	0.0	T	1955	0.0		2	7	0	-	0
July	90.6	56.7	73.7	106	1938	40	1962	.82	1.05	1954	0.0	T	1954	0.0		2	20	0	0	0
Aug.	88.2	55.3	71.7	102	1940	32	1960	1.19	1.03	1949	0.0	0.0		0.0		3	12	0	-	0
Sep.	80.0	47.2	63.6	96	1950	23	1938	1.13	1.67	1962	0.1	2.5	1965	2.5	1965	3	2	0	6	0
Oct.	67.7	36.6	52.2	87	1963	15	1960	.99	1.75	1960	0.2	4.5	1949	3.5	1949	3	0	0	8	0
Nov.	50.5	23.7	37.1	73	1962	0	1959	.56	1.97	1957	2.4	12.5	1951	8.0	1951	2	0	-	26	-
Dec.	40.6	15.9	28.2	60	1962	-10	1948	.89	1.07	1964	8.8	42.0	1951	13.0	1951	3	0	6	28	2
Year	64.2	34.7	49.4	106	July 1938	-29	Jan. 1937	9.77	1.97	Nov. 1957	32.1	42.0	Dec. 1951	13.0	Dec. 1951	29	42	18	167	9

### 3.2 Temperature

The average annual maximum temperature for the period 1936-1976 was 64.2 degrees. The annual mean temperature was 49.4 degrees and the annual minimum temperature was 34.7 degrees. See Figure IV-4.

Summers are characterized by hot days and cool nights. However, the high temperatures are not oppressive since the relative humidity is low. The hottest month is July with the maximum temperature on most days near 90 degrees and the lows in the upper 50's. The maximum temperature record was in July, 1925 at 108 degrees. Recorded summer lows have been 28 degrees in June, 1973 and 31 degrees in July, 1924.

The winters are cold and uncomfortable, but usually not severe, due in part to the protecting influence of the mountain ranges to the north and east which prevent cold arctic air masses from moving into the area. The coldest temperature on record is minus 31 degrees in December, 1924.

Temperatures of 100 degrees or higher during summer or 15 degrees below zero or colder during winter are likely to occur once every three years.

The freeze-free period, or growing season, averages about five months in length, from early May to early October.

Average dates of occurrence of various temperature values are given in the following table:

TABLE IV-8

#### Occurrence of Various Temperatures

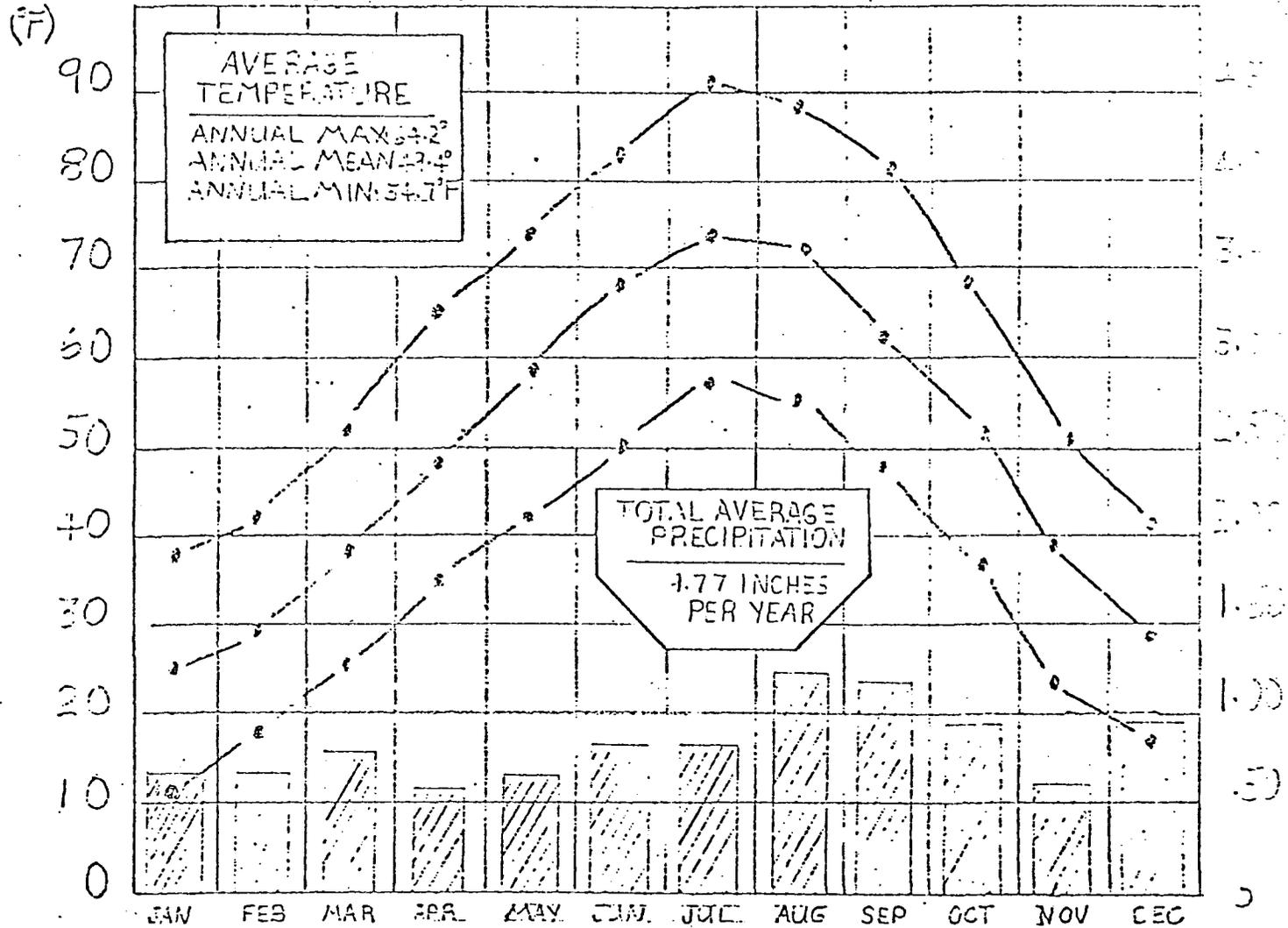
<u>Temperature Equal to or Lower Than</u>	<u>Average Dates of Occurrence</u>	
	<u>Last in Spring</u>	<u>First in Fall</u>
32 <sup>o</sup>	May 3	October 3
28 <sup>o</sup>	April 27	October 15
24 <sup>o</sup>	April 11	October 15
20 <sup>o</sup>	March 29	November 7
16 <sup>o</sup>	March 17	November 16

Table IV-9 gives the average monthly temperature for the area from 1936-1976.

AVERAGE  
TEMPERATURE

# PRICE CLIMATOLOGICAL SUMMARY

## MONTHLY AVERAGES 1936-1965



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FIGURE IV-4

Average Temperature (°F)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Ann1
1936	23.8	31.6	41.0	52.0	61.6	70.2	73.0	71.3	-	-	-	27.6	-
1937	26.0	20.1	37.5	44.5	-	66.1	72.9	75.6	-	52.6	38.6	31.4	-
1938	27.0	32.4	39.0	48.7	55.4	69.4	73.7	73.2	64.8	50.4	29.8	28.4	49.4
1939	24.2	16.1	39.0	51.2	60.3	64.8	-	73.0	63.0	50.0	41.7	32.6	-
1940	23.0	32.2	40.7	50.0	65.6	72.7	73.2	74.4	62.5	54.5	33.3	27.6	50.7
1941	21.8	31.4	41.4	43.9	58.3	-	70.6	70.0	58.9	47.6	37.6	29.9	-
1942	23.4	27.0	35.6	49.0	54.6	67.8	73.2	70.8	61.4	-	-	-	-
1943	24.9	-	-	-	-	66.4	75.1	71.8	67.4	54.0	39.1	31.3	-
1944	23.8	28.2	37.8	46.5	68.9	62.8	73.6	72.6	66.4	55.1	38.6	31.2	49.6
1945	30.5	35.4	38.5	45.0	59.6	63.9	74.5	73.0	62.5	52.6	35.2	23.3	49.5
1946	22.8	31.0	42.7	56.0	57.2	69.8	75.7	72.6	65.4	46.8	36.3	33.6	50.8
1947	25.8	36.3	43.4	49.0	62.6	63.8	75.2	71.2	67.2	56.0	33.2	29.0	51.1
1948	28.6	29.0	34.2	49.1	60.2	67.2	74.0	72.4	67.4	51.1	33.5	25.1	49.3
1949	16.9	20.1	41.2	54.1	58.8	63.6	74.3	72.5	66.0	47.8	43.5	23.6	48.5
1950	17.6	30.5	39.5	51.2	56.2	67.4	69.7	71.1	62.7	56.1	40.9	34.4	49.8
1951	27.7	32.0	39.2	50.0	58.8	64.4	76.9	71.6	65.2	50.3	34.2	20.8	49.3
1952	19.9	25.6	32.4	52.0	61.1	67.9	74.9	72.7	65.9	56.0	35.3	23.9	49.0
1953	28.1	31.9	42.3	47.8	52.9	-	76.6	70.5	66.6	52.6	40.3	27.5	-
1954	30.5	40.6	38.7	54.4	63.2	67.7	76.9	71.3	64.1	53.5	42.5	25.4	52.4
1955	18.0	17.1	35.3	46.6	57.9	66.0	74.7	74.0	66.1	53.3	35.3	30.8	47.9
1956	33.1	28.2	42.2	50.0	61.3	72.1	74.8	70.4	67.7	52.4	33.2	26.3	51.0
1957	24.4	33.9	42.5	47.2	54.8	68.3	73.5	-	-	49.5	33.7	29.4	-
1958	28.8	37.3	35.9	44.8	60.3	67.4	70.7	73.7	62.6	52.9	36.8	33.7	50.4
1959	27.4	32.8	38.9	48.8	54.9	69.4	73.8	70.6	62.4	52.2	38.1	30.6	50.0
1960	19.4	23.2	-	50.8	57.4	67.9	74.1	71.2	64.2	52.6	39.4	31.7	49.3
1961	29.0	33.4	38.2	46.1	57.5	69.8	73.6	61.4	55.3	47.9	33.8	23.5	48.3
1962	24.3	32.7	34.6	52.3	55.3	66.2	71.4	69.6	61.8	52.4	42.3	29.8	49.4
1963	16.3	38.0	36.4	45.2	60.3	63.7	73.7	70.0	64.4	55.3	39.1	25.6	49.0
1964	23.3	27.5	30.4	45.0	55.1	63.2	-	68.9	60.8	53.4	32.6	23.9	-
1965	31.5	-	37.1	-	-	62.0	69.9	68.5	54.8	53.6	41.4	26.9	-

TABLE IV-9

TABLE IV-9

## Average Temperatures (°F.)

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Ann1
1966	M	25.6	38.8	48.6	58.7	63.5	73.1	70.1	60.7	51.5	39.7	26.2	----
1967	22.0	30.8	39.9	41.7	52.8	61.0	73.4	71.2	62.7	51.1	42.4	17.8	47.2
1968	15.8	32.2	40.7	42.5	53.3	----	73.7	67.3	62.6	53.1	39.3	23.8	----
1969	26.8	25.8	33.0	50.4	61.6	64.1	75.5	75.4	65.6	45.2	39.0	33.3	49.6
1970	28.6	37.7	38.2	43.0	59.1	67.5	75.4	75.4	60.6	48.1	39.7	28.3	50.1
1971	27.8	33.4	37.6	48.1	55.3	67.6	74.3	75.4	59.7	49.6	35.8	24.7	49.1
1972	27.8	35.6	47.4	48.3	59.7	68.4	76.7	73.9	63.9	52.3	35.0	22.0	50.9
1973	16.9	26.8	37.1	45.1	57.9	65.1	71.9	72.3	63.9	55.7	38.4	29.2	48.4
1974	18.6	23.2	42.1	45.0	61.6	74.2	78.0	73.6	68.4	M	M	31.3	----
1975	25.0	31.6	41.3	43.7	53.6	59.9	72.3	71.0	63.9	52.1	M	----	----
1976	25.5	36.2	38.2	46.8	58.1	65.4	76.0	70.4	64.0	50.5	----	----	----

Source: National Oceanic and Atmospheric Administration,  
National Climatic Center,  
Asheville, North Carolina

### 3.3 Winds

Winds are light to moderate, although strong winds may occur. The average velocity of the prevailing southwest winds is below 20 mph with peak wind velocities occurring in June and July.

## D. Vegetation Information and Revegetation Plan

### 1. Introduction

Mountain-Brush, Desert Shrub, Pinyon-Juniper Woodland, Sagebrush-Grass, Conifer-Aspen, and minor streamside vegetative types cover the total mine plan area. Most of the area is covered by the Mountain-Brush type while the Pinyon-Juniper Woodland type is predominant in the mine mouth area as well as the access routes and utility corridors; this area has been reseeded with a mixture as recommended by the U.S.D.A. S.C.S. (Also refer to Page 254 re Soil and Vegetation Survey).

### 2. Source of Data

Department of the Interior, 1979. Final Environmental Statement, Development of Coal Resources in Central Utah; Part 1 Regional Analysis, Part 2 Site Specific Analysis.

United States Department of Agriculture, Soil Conservation Service, May, 1980. Soil Survey and Interpretations, Vegetation Survey.

Centennial Coal Associates, May, 1976 Mining Application. Submitted to the United States Geologic Survey, Conservation Branch.

A.M.C.A. Coal Leasing, June, 1978 Mining and Reclamation Plan (Zion's fee). Submitted to the State of Utah, Department of Natural Resources, Division of Oil, Gas, and Mining.

### 3. Description

#### 3.1 Vegetative Types See EEC report following page 254.

The vegetative types include Mountain Brush, Pinyon-Juniper Woodland, Sagebrush-Grass, and Conifer-Aspen.

#### 3.2 Threatened of Endangered Species

There have been no known threatened or endangered species observed in the lease area (Welsh 1977).

3.3 Plant Communities See EEC report following page 254.

The Mountain Brush type is the largest in the area. It is found predominately at elevations of about 7,500 feet. This community consists of sage, mountain mahogany, serviceberry, snowberry, squaw apple, gambels oak, and maple. Minor amounts of rabbitbrush, cliffrose, and bitterbrush can be found. Associated grass species are wildrye, Indian ricegrass, wheat grass, bull grass, and blue grass.

The Sagebrush-Grass group is present from 7,200 to 9,000 feet on and in the low benches below the cliffs. Sage and rabbit brush appear associated with the common grasses occurring in other communities such as curly grass, indian rice grass, and bull grass. Four-wing and saltbrush is found on better drained soils. Shad scale and curly grass associations are found on the heavier clay soils.

The Pinyon-Juniper Woodland community occurs in the area from an elevation of 5,600 to 8,000 feet and dominates the area below the excarpment of the Book Cliffs. Pinyon pine and Utah juniper are the dominant species with bull grass, indian rice grass, and birch leaf mahogany as associated species.

The Conifer-Aspen becomes fairly extensive in the more moist sites and at higher elevations. Elevations range from about 7,000 to 9,000 feet. Aspen predominates at the lower elevations with associated species being serviceberry, snowberry, Oregon grape, mountain brome, and peavine. Douglas fir is scattered throughout the area above 7,500 feet elevation. A few big red pine, white pine, and fir are found in the upper canyon bottoms. Understory grasses present include curly grass, indian rice grass, shadscale, black sage, and crested wheat grass.

Identified species of noxious or poisonous weeds in the area are halogeton, cockleburr, loco, and copperweed. There are no concentrated areas or serious problems from these poisonous plants.

Some of the most important vegetation species are listed in Table IV-7.

IV-10

TABLE IV-10

Vegetation Possibly Occuring in Area

<u>Common Name</u>	<u>Scientific Name</u>
<u>Grasses:</u>	
curly grass	Hilaria jamesii
indian rice grass	Oryzopsis hymenoides
squirreltail	Sitanian hystix
Needle and thread grass	Stipa commata
no eatum grass	Aristida fendleriana
western wheat grass	Agropyron smithii
bull grass	Elymus salinus
<u>Shrubs:</u>	
nuttal saltbush	Atriplex nuttallii
mat saltbush	Atriplex corrugata
shadscale	Atriplex confertifolia
fourwing saltbush	Atriplex canescens
big sagebrush	Artemisia tridentate
black sagebrush	Artemisia arbuscula nova
greasewood	Sarobatus vermiculatus
small rabbitbrush	Chrysothamnus viscidiflorus
big rabbitbrush	Chrysothamnus nauseosus
mountain-mahogany	Cercocarpus montanus
serviceberry	Amelanchief alnifolia
curlleaf mahogany	Cercocarpus ledifolius.
squaw apple	Peraphyllum ramosissimum
snowberry	Symphoricarpos oreophilus
<u>Trees:</u>	
juniper	Juniperus osteosperma
pinion	Pinus edulis
ponderosa pine	Pinus ponderosa
aspen	Populus temuloides
limber pine	Pinus flexilis
douglas fir	Pseudotsuga menziesii.
gambel oak	Quercus gambelii

### 3.4 Extent of Cover

Since the elevations and terrain varies drastically from steep walled canyons to high ridges, vegetation density also varies. Percent cover is greater at the higher elevations and on the gentler topography. The Bureau of Land Management estimates cover of 25 to 30 percent at the higher elevations and 10 to 12 percent on the lower canyon sides and bottoms.

### 3.5 Shrub Height

Shrub height varies over the lease area. Topography, aspect, elevation, and soil cause these modifications.

## 4. Area to be Disturbed

The surface area disturbed is very minimal, approximately 33 acres as shown on Plate 6. Site of the present surface facilities is located in an area that has been previously impacted by mining activities. Actual plant communities which have been disturbed are the Pinyon-Juniper and associated species and similar impact is foreseen on vegetation overlying the remainder of the lease area at the proposed surface facilities' sites. Extreme care will be taken however, to disturb as little vegetation as possible and revegetation has been immediately carried out on all disturbed areas no longer needed for the mining operation.

## 5. Revegetation Plan

### 5.1 Schedule of Revegetation

The seeding of native flora (consisting where possible of deer browse species), will commence as soon as is practical following shutdown and abandonment to stabilize erosion. Agencies such as the B.L.M., O.S.M., and Utah Department of Natural Resources will be consulted at the time for recommendations on recontouring, soil reconditioning, and revegetation. Revegetation will be accomplished by Andalex or under Andalex's direct supervision and under the recommendations of the regulatory authorities.

### 5.2 Soil Testing Plan and Soil Preparation

Where possible the soil will be distributed along the contour. The thickness of the re-established soil will be sufficient to support vegetation equal to or superior to pre-mining history. Soils will be tested according to the most advanced technology. Samples will be taken to determine any deficiencies which would effect the growth of newly revegetated areas. Any deficiencies will be corrected by adding to the soil chemical fertilizers, organic mulch, or any other substances recommended by the regulatory authority. All preparation will be according to UDOGM guidelines.

5.3 Species and Amounts of Seeds and Seedling (refer to seed list following this page).

At the recommendation of the Bureau of Land Management, the following species and rates could be used:

Ladak Alfalfa - 2 lbs./ac.  
Yellow Sweetclover - 2 lbs./ac.  
Indian Ricegrass - 4 lbs./ac.  
Antelope Bitterbrush - 3 lbs./ac.  
Western Wheatgrass - 3 lbs./ac.

5.4 Planting and Seeding Methods

Where possible the areas will be disced using conventional farm equipment. The seed will spread using a rangeland drill where possible. Areas which cannot be seeded mechanically will be hand seeded. Steeper slopes will be raked to provide a slight soil cover for the seed. Andalex will adhere to UDOGM guidelines.

5.5 Mulching Techniques

Vegetative cover will be promptly re-established following cessation of mining activities to stabilize erosion. Mulch will be used and re-seeding will occur during the first normal period for favorable growth following regrading. Andalex will adhere to UDOGM guidelines.

5.6 Management Practices, e.g., Irrigation, Pest, and Disease Control

No mechanical irrigation will be used because of the lack of water in the area. Vegetative growth will be subject to normal rainfall and winter snowfall. Vegetation will be protected from both wildlife and livestock by drift-fences until the reclaimed areas have been adequately re-established. Upon approval the fences will be removed.

5.7 Measures to Determine Success

Revegetation will be closely monitored. Areas which fail to support sufficient growth to stabilize conditions will be tested and reseeded until a proper cover is established. Physical examinations will be conducted to note any species which are not thriving or regenerating. If this occurs, species will be substituted at the recommendation of the regulatory authority. Any other species will be added at the time of reclamation upon recommendation of the regulatory authority. The company will maintain close contact with the Bureau of Land Management in all of its revegetation efforts, and incorporate their suggestions into its overall plan. All reclaimed areas will be monitored and maintained by the constant observation of Andalex until the surety release is granted.

Recommended Seed Mix for Steep Slope Areas  
Andalex Resources, Inc.

SPECIES	<u># PLS/acre</u>
<u>Grasses:</u>	
<u>Agropyron smithii</u>	3.0
Western wheatgrass	
<u>Agropyron spicatum</u>	2.0
Bluebunch wheatgrass	
<u>Agropyron trachycaulum</u>	2.0
Slender wheatgrass	
<u>Bromus marginatus</u>	3.0
Mountain brome	
<u>Oryzopsis hymenoides</u>	2.0
Indian ricegrass	
<u>Poa sandbergii (secunda)</u>	0.25
Sandberg bluegrass	
<u>Forbs:</u>	
<u>Artemisia ludoviciana</u>	0.1
Louisiana sagebrush	
<u>Hedysarum borealis</u>	1.0
Northern sweetvetch	
<u>Linum lewisii</u>	1.0
lewis flax	
<u>Melilotus officinalis</u>	0.5
Yellow sweetclover	
<u>Penstemon strictus</u>	0.25
'Bandera' Rocky Mtn. penstemon	
<u>Shrubs:</u>	
<u>Amelanchier alnifolia</u>	1.0
Serviceberry	
<u>Artemisia tridentata vaseyana</u>	0.2
Mountain big sagebrush	
<u>Cercocarpus ledifolius</u>	1.0
Curleaf mountain mahogany	
<u>Cercocarpus montanus</u>	1.0
True mountain mahogany	
<u>Chrysothamnus nauseosus albicaulis</u>	1.0
Whitestem rubber rabbitbrush	
<u>Purshia tridentata</u>	3.0
Bitterbrush	
<u>Symphoricarpos oreophilus</u>	1.0
Mountain snowberry	
Total . . .	<u>23.3</u>

Rate is pounds Pure Live Seed/Acre for drill seeding. Broadcast seeding is double the drill rate.

12/10/86

Recommended Seed Mix for Drainage Areas  
Andalex Resources, Inc.

SPECIES	<u># PLS/acre</u>
<u>Grasses:</u>	
<u>Agropyron riparium</u>	2.0
Western wheatgrass	
<u>Agropyron trachycaulum</u>	2.0
Slender wheatgrass	
<u>Bromus marginatus</u>	3.0
Mountain brome	
<u>Elymus cinereus</u>	2.0
Great Basin wildrye	
<u>Phalaris arundinacea</u>	0.5
Reed canarygrass	
<u>Poa pratensis</u>	0.1
Sandberg bluegrass	
<u>Forbs:</u>	
<u>Achillea millifolium</u>	0.1
Yarrow	
<u>Artemisia ludoviciana</u>	0.1
Louisiana sagebrush	
<u>Hedysarum borealis</u>	1.0
Northern sweetvetch	
<u>Melilotus officinalis</u>	0.5
Yellow sweetclover	
<u>Osmorhiza occidentalis</u>	2.0
Sweet anise	
<u>Shrubs:</u>	
<u>Amelanchier alnifolia</u>	1.0
Serviceberry	
<u>Artemisia tridentata vaseyana</u>	0.1
Mountain big sagebrush	
<u>Rhus trilobata</u>	1.0
Squawbush	
<u>Sambucus cerulea</u>	1.0
Blue elderberry	
<u>Symphoricarpos oreophilus</u>	1.0
Mountain snowberry	
Total . . .	<u>17.4</u>
<u>Trees (transplants):</u>	
<u>Populus angustifolia</u> (Narrowleaf cottonwood)	#/Acre 250
<u>Acer negundo</u> (Box Elder)	250
<u>Prunus virginiana</u> (Chokecherry)	250
<u>Quercus gambelii</u> (Gambel oak)	250
Total . . .	<u>1000</u>

Rate is pounds Pure Live Seed/Acre for drill seeding. Broadcast seeding is double the drill rate.

12/10/86

## E. Fish and Wildlife Resources and Plan

### 1. Introduction

The mine plan area is located in the West Tavaputs Plateau, a region which supports about 360 vertebrate wildlife species. The abundance and distribution of wildlife in the lease area is directly related to present land use activities and capabilities. Use of this area by certain species is limited to lack of perennial water. Wildlife species possibly occurring in the lease area are listed in Table IV-11. Please refer to Plate 34.

### 2. Source of Data

Department of the Interior, 1979. Final Environmental Statement - Development of Coal Resources in Central Utah, Parts 1 and 2.

Utah Department of Natural Resources, Division of Fish and Wildlife.

### 3. Habitats

Previously described vegetation provides fair to excellent habitat for a variety of wildlife species.

### 4. Species (See Table IV-11).

#### 4.1 Mammals

Mammals occurring in the area can be divided into two groups, game species and non-game species.

The main game species include mule deer, mountain lion, black bear, elk, and cottontail rabbits. Mule deer, however, are the most important wildlife resource in the area. Mountain lion are present but little information is available due to their ranging habits. Generally, their movement coincides with the migration of deer. Black bear may occasionally be found in the vegetated canyons, usually along the cliff face. They normally inhabit the Book Cliffs to the north but little data is available on their populations. The permit area is within the lower limits of the elk range, however, elk are generally found north of the mine plan area at higher elevations. Cottontail rabbits are distributed throughout the area.

Non-game mammals include several species of small animals inhabiting the area. Predator species such as coyote and bobcat occasionally are found in the area and depend on small rodents and rabbits for their source of food. Information on non-game species is generally unavailable.

TABLE IV-11

## List of Animals Possibly Occurring in Lease Area

<u>Common Name</u>	<u>Scientific Name</u>
<u>Mammals</u>	
Badger	Taxidea taxus
Black Bear	Ursus americanus
Bobcat	Lynx rufus
Coyote	Canis latrans
Deer mouse	Peromyscus maniculatus
Desert Cottontail	Sylvilagus audubonni
Elk	Cervus elaphus
Ground Squirrel	Spermophilus tridecelineatus
Least Chipmunk	Eutamias minimus
Mountain Lion	Felis concolor
Mule Deer	Odocoileus hemionus
Porcupine	Erethizon dorsatum
Striped skunk	Mephitis mephitis
White-tailed Jackrabbit	Lepus townsendii
<u>Birds</u>	
Brewers Sparrow	Spizella breweri
Blue Grouse	Dendragapus obscurus
Common Nighthawk	Chordeiles minor
House Sparrow	Passer Domesticus
Lark Sparrow	Chondestes grammacus
Magpie	Pica pica
Mourning Dove	Zenaidura macroura
Pinyon Jay	Gymnorhinus cyanocephala
Red-tailed Hawk	Buteo jamaicensis
Robin	Turdus migratorius
Ruffed Grouse	Bonasa umbellus
Sage Grouse	Centrocercus urophasianus
Sparrow Hawk	Falco sparverius
Turkey Vulture	Cathartes aura
Vesper Sparrow	Pooecetes gramineus

## 4.2 Birds

### 4.2-1 Raptors

The turkey vulture and red-tailed hawk frequent the area. A variety of other raptors breed in the Price area, however, there is a poor density of raptors throughout the mine plan area. A raptor survey performed for Tower Resources of the proposed permit area by Clayton M. White of Brigham Young University is attached as Appendix J. See Plate 34.

### 4.2-2 Other

Sage grouse inhabit the sagebrush flats at the foot of the cliffs. Blue and ruffed grouse may occasionally be found in the vegetated canyons of the area. Chukars can be found around the cliffs. Mourning doves are generally distributed throughout the area, however, the lack of perennial water limits dove nesting habitat in the area. Other representative birds include the magpie, bluebird, robin, and several species of sparrow.

### 4.3 Reptiles and Amphibians

The most prominent species of reptiles include the rattlesnake and sagebrush lizard. No aquatic fauna are present in the area.

### 4.4 Fish

There are no active fisheries as there are no permanent bodies of water or perennial streams in the area. No aquatic fauna are found.

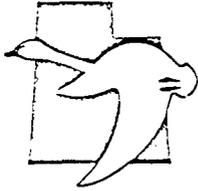
### 4.5 Threatened or Endangered Species

There have been no known threatened or endangered species on or near the lease area according to a survey conducted by the Utah Division of Wildlife Resources (Bonner 1977).

## 5. Impacts of Operations

Construction of all roads, powerlines, and surface facilities has been completed and mining operations have commenced. Therefore, no additional impact of operations on wildlife is anticipated.

## 6. Fish and Wildlife Plan (See plan following page 221.)



# DIVISION OF WILDLIFE RESOURCES

DOUGLAS F. DAY  
Director

EQUAL OPPORTUNITY EMPLOYER

1596 West North Temple/Salt Lake City, Utah 84116/801-533-9333

April 13, 1981

Reply To SOUTHEASTERN REGIONAL OFFICE  
455 West Railroad Avenue, Box 840, Price, Utah 84501  
(801) 637-3310

Mr. Sam Quigley  
Tower Resources Inc.  
Centennial Mining Project  
82 West Main  
Price, Utah 84501

Attention: Mike Glasson

Dear Sam:

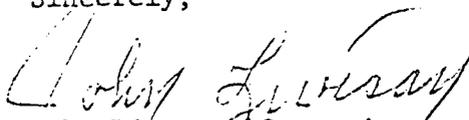
I want to take this opportunity to extend thanks for the assistance you and Mike have provided our staff in becoming familiar with existing and planned surface facilities on the area encompassed by Tower Resources Inc.'s Centennial Mining Project. I believe that you will find the enclosed information helpful at filing a mine and reclamation plan.

In response to your request for wildlife resource information (UMC 783.20) the attached map, data and comments are provided. The wildlife resource information is consistent with the formal guidelines for acquisition of fish, wildlife and habitat information that will be provided your Company by Utah's Division of Oil, Gas and Mining. In instances where your Company was or will be required to provide for study beyond existing information, such findings need be appended to this report.

Please note that the enclosed wildlife plan (UMC 784.21) represents our recommendations; Utah's Division of Oil, Gas and Mining is the regulatory authority for approval of the mining and reclamation plan. Implementation of the recommended wildlife plan should assist the Company in compliance with performance standards UMC 817.97.

Thank you for an opportunity to assist your Company in complying with the State's permanent program for coal mining and reclamation and the resultant protection of Utah's wildlife resources. If the Division can be of any further service, please coordinate with our Regional Resource Analyst (Larry Dalton, phone 801-637-3310) as appropriate.

Sincerely,

  
John Livesay, Supervisor  
Southeastern Region

JL:LBD:gp

Enclosure

UMC 784.21; FISH AND WILDLIFE PLAN  
Tower RESOURCES INC., CENTENIAL MINING PROJECT

Mitigation and Impact Avoidance Procedures General to all Wildlife

Utah Division of Wildlife Resources provides the following recommendations in order to minimize disturbances and impacts on wildlife and their habitats that could be impacted during developmental, operational and reclamation operations at the Company's mining project. The recommendations address how enhancement of the wildlife resource and their habitats as discussed in UMC 783.20 can be achieved. They are also consistent with the performance standards of UMC 817.97. In instances where it would be necessary to restore or could be beneficial to enhance or develop high value habitats for fish and wildlife, recommended plant materials and rates of application are provided as "Appendix B" (UMC 817.97 and UMC 817.111 through 817.117). This list should prove useful in meeting the additional requirements to be imposed upon the operator if the primary or secondary land use will be for wildlife habitats (UMC 817.97 d 9). Additionally, "Appendix C" represents a list of commercial sources for plant materials.

The project and adjacent areas are represented by seven basic wildlife habitats which are inhabited on occasion and during different seasons of the year by about 184 species of vertebrate wildlife. The wildlife habitats and use areas for the "high interest" species from this group of wildlife have been ranked into four levels of importance. The most valuable to an individual species or ecological assemblage are the critical sites followed in respective importance by high-priority, substantial value and limited value sites. Each type of use area requires various and specific levels of protection from man's activities. Additionally, due to the variability of vegetation communities in each use area, various and specific technologies in site development will need to be evaluated for possible mitigations, enhancements of wildland habitats or the required level of reclama-

tion. It is recommended that all land clearing impacts be designed so that irregular shaped openings are created in contrast to openings that would have straight edges.

It is recommended that the Company make significant efforts to educate all employees associated with their coal handling operation of the intricate values of the wildlife resource associated with the project and adjacent areas and the local area. Each employee should be advised not to unnecessarily or without proper permits harass or take any wildlife. (Apprehension of wildlife violators has increased by nearly 250 percent during recent years in the region). It is especially important that wildlife not be harassed during winter periods, breeding seasons and early in the rearing process. Exploration should be limited as much as possible during these crucial periods.

During winter wildlife are always in a depleted condition. Unnecessary disturbance by man causes them to use up critical and limited energy reserves which, often times, results in mortality. In less severe cases, the fetus being carried by mammals may be aborted or absorbed by the animal, thus reducing reproductive success of a population.

During breeding seasons, disturbance by man can negatively affect the number of breeding territories for some species of wildlife. Disturbance can also interrupt courtship displays and preclude timely interactions between breeding animals. This could result in reduced reproductive success and ultimate reductions in population levels.

Early in the rearing process, young animals need the peace and tranquillity normally afforded by remote wildlands. It is also during this crucial period that young animals gain the strength and ability to elude man and other predators. This allows the young animal to develop in relatively unstressed situations and to utilize habitats that are secure from predators. Disturbance by man can compromise this situation and result in abandonment of the young by the female, increased accidents that result in mortality to young animals or increased natural predation.

It is recommended that employees be cautioned against disturbing young animals or females with young if accidentally located.

Employees associated with coal handling operations should be instructed that when wildlife are encountered during routine work that they not stop vehicles for viewing purposes. Moving traffic is less disturbing to wildlife than traffic that stops or results in out-of-the-vehicle activities. If viewing is desirable, the vehicle should only be slowed, but not stopped.

Hunting and other state and federal wildlife regulations must be adhered to by sportsmen utilizing the project area.

#### Mitigation and Impact Avoidance Procedures for Aquatic Wildlife

There are no recommendations for a wildlife plan that would enhance any perennial water or fishery since none are associated with the Company's proposed operation.

#### Mitigation and Impact Avoidance Procedures for Terrestrial Habitats

It is recommended that all habitats associated with dry washes be maintained. Roads and other facility developments should not destroy or degrade these limited and highly productive habitats. Roads crossing through those areas should do so in a manner that is least damaging to the habitat. Wetlands and riparian habitats associated with dry washes are of similar character to riparian habitats in other areas. They are ranked as being of critical value and are the most productive sites in terms of herbage and biota produced as compared to other local habitat types. It is probable that a majority of the vertebrate wildlife that inhabit the project area make some use of such sites.

It is important to note that roads and other surface facilities to be constructed should as far as practicable be placed at sites where they will not compromise wildlife or their use areas. Also, surface facilities, including roads, should be screened if possible from wildlife use areas by vegetation or terrain.

In situations where wildland habitats have been or will be disturbed, reclamation is required. Also, there are sites where development or enhancement of

wildland habitats through vegetation treatments and/or seedlings and transplants of seedlings could benefit wildlife. "Appendix B" depicts the Division's recommendation for plant materials to be utilized for various wildlife habitats on wildland treatments that are intended to benefit wildlife. If circumstances arise where seed or seedling transplants for a recommended plant species are not available, suitable alternates are also recommended.

Seedling transplants from nursery stock as well as nearby rangelands would also be acceptable for some wildland treatments.

Appendix C represents an exhaustive list of commercial sources for plant materials for use in wildland treatments.

Temporary control of rodents may be required to ensure a successful rangeland treatment. It is recommended that the county agent be consulted in this area of concern. Poisoned oats are the most common and acceptable method for rodent control; however, only licensed persons may apply the treatment.

Currently, there are some new concepts in methodology for revegetation that are being successfully implemented in other parts of the nation and world. One promising method is a procedure where a large scoop removes, from a natural and stabilized site, a small area of earth intact with vegetation and subsurface soils for placement on a site to be restored. This same procedure can be utilized when disturbing pristine sites, except that the native vegetation is stored for use in latent reclamation. Another meritorious method for stimulating natural revegetation, in combination with other reclamation techniques, is to plan facility developments so that islands of natural, native vegetation remain. This will allow for natural vegetation to spread from the islands. These techniques can also be useful for enhancement of poor quality sites that currently exist on the mine plan area.

Encapsulation of seed and fertilizer for several releases over a period of years after a single application is a new and possibly advantageous procedure. This technique along with soil stabilizing structures has been successfully used in South Africa. Dr. J. Van Wyk in the Department of Botany at Potchetstroom

University in South Africa could provide additional information on this new technique.

There are also new specialized techniques coming to the forefront for stabilization of problem sites such as roadbanks and steep slopes. It is important that these sites be promptly and permanently revegetated in order to reduce siltation into local riverine systems. This will mitigate for damage to aquatic wildlife populations and habitats from siltation. Enhancement of existing problem sites or reclamation of disturbed sites can mitigate for salt loading of local river systems. It is believed that natural, nonpoint sources represent 50 percent of the salinity in the upper basin of the Colorado River system into which this mine plan area drains.

It is recommended the Company make numerous contacts with appropriate agencies, institutions and persons to ensure that enhancement or reclamation projects achieve the required degree of permanency, plant diversity, extent of cover and capability of regeneration to ensure plant succession. Generally speaking, seeding should be accomplished as late in the fall as possible. Seedling transplants need to be coordinated with local soil moisture conditions which are usually at optimum in the early spring just as the snow melts.

It is paramount that suitable vegetation be maintained and/or re-established if the life requirements of wildlife are to be satisfied in the postmining period. Success in this area of concern along with cessation of man's disturbances will likely result in a natural reinvasion and the resultant inhabitation by most wildlife species of an impacted site.

It is important to note that enhancement or reclamation projects that are to benefit wildlife must be properly designed so that all the life requirements of the target species are considered in conjunction with forage. Water must be provided or be present and thermal cover along with escape and hiding cover has to be in abundance. Loafing areas and travelways between the many types of use areas must also be provided. In order to meet these goals, a considerable degree of consul-

tation will be required between the Company and Utah Division of Wildlife Resources.

As a service and also to ensure that the needs of wildlife are met, the various expertism within the Division of Wildlife Resources are available to the Company for consultation. For the most part, Larry Dalton, Resource Analyst, for the Southeastern Regional Office at 455 West Railroad Avenue in Price, Utah 84501 (phone 637-3310) will coordinate any needed contacts. Richard Stevens, Wildlife Biologist, at the Great Basin Research Center, Box 704, in Ephraim, Utah 84627 (phone 283-4441) is available for consultation and site specific analysis concerning species for vegetation plantings, timing and techniques to achieve the best results.

In instances where revegetation projects are to be planned over coal waste areas, heavy metal uptake by the plants must be evaluated. It is recommended that the Company initiate an appropriate long-term monitoring program to determine the magnitude and resolutions, if needed, for this problem.

It is recommended that persistent pesticides not be utilized on the project area. Other alternate pesticides or forms of control should be utilized.

All hazards associated with the project operation should be fenced or covered to preclude use by wildlife; of special concern would be sites having potential to entrap animals or toxic materials.

#### Mitigation and Impact Avoidance Procedures for Amphibians and Reptiles

Enhancement or development of habitats that provides a diversity of vegetation will benefit amphibians and reptiles. It is important to note that all of these species are protected by Utah law. Due to the myriad of myths that surround these animals, it is urged that individual specimens not be destroyed. This is especially true for snakes since they are a valuable component of the ecosystem.

Snake dens are ranked as being of critical value to the population and are protected by law. If a den is located, it should be reported to the Utah Division of Wildlife Resources. Snake dens can be moved, but only with intensive efforts that may take a year or more (snakes are caught and removed in the spring and fall).

Thus, construction of facility developments may take place in denning locations if there is sufficient lead time to relocate the occupants.

#### Mitigation and Impact Avoidance Procedures for Avifauna

It is recognizable that development and operation of a mining project will in some cases negatively impact many avian species through physical destruction of habitats and continual disturbance that makes other habitats unavailable or less desirable to an individual bird. It is also true that impacts that are negative to one species may be beneficial to another species. It is recommended that the Company plant native and/or ornamental berry producing shrubs around surface facilities. When mourning doves are a target species, sunflowers or blazing star should be planted. This will provide food and cover for many of the smaller species of birds, resulting in enhancement of their substantial value and high-priority habitats. This action would also mitigate for disturbances and destruction of avifauna habitats at other sites associated with project operations.

It is important to note that the nests of all avifauna (except the house sparrow, starling and ferral pigeon) when active and their eggs are protected by federal (Federal Migratory Bird Treaty Act) or state laws (Utah Code 23-17-1 and 23-17-2). All avifauna utilize a nest during their reproductive process. Dependent upon the species, some nests are well developed while others may be represented by only a scrape on the ground. These sites when being utilized are critical to maintenance of individual bird populations; each species has a specific crucial time period in which the nest is occupied. It is during this crucial period that the nest must be protected from disturbance.

Several species of raptors frequent the project area. Their nests when active should not be disturbed and abandoned stick nests are never to be damaged. Every effort should be made to eliminate man's disturbance within visual sight or one-half kilometer radius of an active raptor nest. This distance would have to be increased to a one-kilometer radius if the cause for disturbance were to originate within view and from above the nest. This effort is demanded in the instance of

golden eagles and cliff nesting falcons since they are sensitive to disturbance and could abandon the nest. Termination of man's use of a site would not be required if eagles or falcons constructed their nest after mining had been initiated, since it would demonstrate the individual bird's willingness to tolerate mining activities and the associated disturbance by man.

Roost trees for eagles, if located, must not be disturbed or destroyed. Similarly, activities planned for high-priority concentration areas of eagles must be designed and implemented so that they are not of significant disturbance to the birds.

As a general comment, whenever active raptor nests are observed or roost trees for eagles located, they need to be reported to the Utah Division of Wildlife Resources and the U.S. Fish and Wildlife Service.

Design and construction of all electrical power lines and other transmission facilities shall be designed in accordance with guidelines set forth in "Environmental Criteria for Electric Transmission System" published by the USDA and USDI in 1970 and/or the REA Bulletin 61-10 "Powerline Contacts by Eagles and Other Large Birds". It is also recommended that placement of utility poles over flat or rolling terrain be planned so that they are out of view of roads or at least 300 meters away from any roads. This will lessen opportunity for illegal killing of these valuable birds, since the poles can serve as suitable hunting perches for raptors. In some instances poles can result in an extension of raptor hunting territories, which would represent a beneficial impact.

During the crucial period of December through February spruce-fir forests and aspen forests need to be protected from man's disturbance so that blue grouse will not be impacted. Destruction of these wildlife habitats at any time of the year need be minimized due to their value to wildlife.

During the spring period (mid-March through mid-June) care needs to be taken that male blue grouse are not disturbed or precluded from establishing breeding territories.

Mature trees with natural cavities and dead snags need to be protected for use by cavity nesting birds. Trees with such a character are ranked as being of critical value to cavity nesting birds. The project should be planned so that three such trees are left standing per acre within 500 feet of forest openings and two such trees per acre in dense forested areas.

#### Mitigation and Impact Avoidance Procedures for Mammals

The lodges, nests and dens of all mammals or roosts in the instance of bat like mammals represent a critical use area for maintenance of their individual populations. The crucial period for any species is when the lodge, den, nest or roost is occupied. Therefore, such sites for any mammal must be protected from disturbance during that period when it is being utilized.

Many species of mammals develop food caches in order to carry individual animals or family groups through periods when they cannot forage. Such sites are of critical value to maintenance of their populations and if located should not be destroyed or subjected to regular disturbance by man.

It is important to realize that within natural ecosystems there exists a predator-prey relationship. One species of animal may represent a prey source for other species. Therefore, it is important that project operations be designed and implemented so as to not unnecessarily disturb or destroy any wildlife or their habitats.

Big game ungulates--mule deer and elk--each have seasonal use areas ranked as being of critical value to an individual herd. Such sites need to be protected from any of man's activities or developments that could result in destruction, loss or permanent occupancy of the site by man or has facility developments. If these types of impacts cannot be avoided the site must ultimately be reclaimed and revegetated. Also, critical valued areas need protection from disturbance during their appropriate crucial period.

High-priority valued use areas for all wildlife and particularly big game ungulates need to be protected from man's activities or facility developments.

Actions that would result in loss or permanent occupancy of significant acreages (25 or more acres) of habitat are of special concern. In any event impacts to high-priority valued areas should be limited and ultimate reclamation planned. Many impacts can be avoided simply by precluding exploration, developmental or other activities during the period of time when a high interest specie is present.

Haulage of coal between the various mine projects and distribution points should be planned so that impacts to wildlife are lessened; of special concern is haulage of coal through wintering areas for big game. It is recommended that the Company, when hauling coal with motor vehicles, develop coal haulage contracts that require personnel involved with coal haulage to use extreme caution so that accidental collisions between motor vehicles and big game are reduced. Without doubt, a reduction in speed across winter ranges would alleviate this problem during the period between November 1 and May 15 each year.

At present the most successful and cost effective technique for reducing deer-highway mortality is a system of warning reflectors. This system (manufactured by Strieter Corporation, 2100 Eighteenth Avenue, Rock Island, Illinois 61201 and known as "Swareflex") is only of value at night time, but it is during darkness that most deer-highway mortality occurs. Strieter Corporation describes the effect of the reflector system as follows: "The headlights of approaching vehicles strike the wildlife reflectors which are installed on both sides of the road. Unnoticeable to the driver, these reflect red lights into the adjoining terrain and an optical warning fence is produced. Any approaching wildlife is [are] alerted and stops or returns to the safety of the countryside. Immediately after the vehicle has passed, the reflectors become inactive, thereby permitting the animals to cross safely".

Installation of a wildlife warning reflector system, a reduction in speed of coal-haulage trucks and other mine related traffic and increased awareness of wildlife values by mine associated employees should result in a reduction of deer-highway mortality problems. Such a reduction would represent satisfactory miti-

gation.

In instances where conveyors, slurry lines or any other structure having potential to be a barrier to big game movement is to be developed, passage structures must be provided. Generally speaking overpass and underpass type structures are recommended in order to allow passage of big game to habitats either side of any barrier. These crossings should be placed at the points to be identified from intensive study of big game movements in relation to the mine plan area. Such study would not be required if the structure was adequately elevated to allow uninhibited passage of big game along its entire length.

Underpasses should have a minimum clearance of three meters maintained across a span of at least five meters. Overpasses should be designed as a circular earthen ramp with the barrier bisecting the ramp into two equal halves as follows:

On either side of the conveyor a half-round ramp with a slope no greater than 3:1 on a five meters wide path placed at an angle 90 degrees to the conveyor and tapering around to a slope of 5:1 at paths adjacent and parallel to the conveyor. The platform over the conveyor should be concrete or some other material that would not echo when being crossed by big game and should be of character similar to rock or natural earth.

Soils associated with either crossing style should be of the A or B horizons to allow for development of vegetation. Vegetative cover must be established in association with all crossing sites. This will lessen anxiety of individual animals using the site through development of a natural appearing environment.

Mature pinion or juniper trees and an abundance of browse plants need to be placed proximal to crossing points in order to provide a safe travelway. The browse plants will also serve as a permanent attraction for big game to crossing points. Additionally, a mixture of grass and forb seeds should be broadcast over each crossing point to stabilize the soil and enhance the forage situation.

Appropriately sized boulders may need to be placed at crossing sites in order to control off-road vehicles utilized in outdoor recreation.

Industrial developments are encouraged on habitat use areas that are ranked as being of limited value to wildlife. It should be noted, however, that reclamation is not to be accepted on any wildlife use area regardless of its value to

Table 1. Ranking of value for ecological association for wildlife habitats of vertebrate species having high interest to the state of Utah. Crucial-critical (C) habitats the highest valued followed in respective order high-priority (H), substantial value (S) and limited valued (L) habitats.

Ecological Association	Wildlife Habitats										
	Riparian and Wetland	Desert Scrub	Pasture and Fields	Urban or Parks	Cliffs and Tallus	Sagebrush P-J Forest	Shrubland	Aspen Forest	Ponderosa Forest	Parkland	Spruce-fir Forest
Warm Desert	LOWER SONORAN LIFE ZONE This ecological association does not exist in the Southeastern Region										
Cold Desert C(H <sup>1</sup> , S <sup>2</sup> )	S	S	S	S	H						
Submontane C(H <sup>1</sup> , S <sup>2</sup> )		S	S	H	S	S	S				
Montane C(H <sup>1</sup> L <sup>2</sup> )		S	L	S				S	S	S	S
Montane H(S <sup>1</sup> , L <sup>2</sup> )				S							S
Montane	ALPINE LIFE ZONE This ecological association does not exist in the Southeastern Region										

This Table represents a summation of effort where by numerical values were assigned as a ranking per high interest specie to each wildlife habitat. The numerical values were as follows: critical, 1; high-priority, 2; substantial, 3; and limited, 4. Once the individual values were assigned they were then summed and a mean calculated, for each wildlife habitat. A mean value lying between 1.0 and 1.8 was ranked as critical; a value between 1.9 and 2.3 was ranked as high-priority; a value between 2.4 and 3.4 was ranked as substantial; and a value between 3.5 and 4.0 was ranked as limited.

1. Habitat ranking value for species associated with the riparian-wetland type that represents just the wet meadow situation.
2. Habitat ranking value for species associated with the riparian-wetland type that represents just the dirt bank situation.

in Utah. Crucial-critical (1), sections are the highest valued followed in respective order by high-priority (2), substantial value (3) and limited valued (4) sections.

BOOK CLIFFS

T.	R.	Section	Rank
12	8	1-36	1
12	9	2,4-12,14,16-18,31-35	1
		1,3,13,15,19-30,36	2
12	10	2-11,13-17,19-27	1
		1,12,18,28-36	2
12	11	16-28,33-35	1
		1-15,29-32,36	2
12	12	19,27-30,32-34	1
		1-18,20-26,31,35,36	2
13	8	1-3,5-16,19,20,22-24,28-31	1
		4,17,18,21,25-27,32-35	2
13	9	1-11,14,15,17,18,28,29,31-35	1
		12,13,16,19-27,30,36	2
13	10	1,2,6	1
		3-5,7-36	2
13	11	14-16,21-28,34-36	1
		1-13,17-20,29-33	2
13	12	4,19,30,31,35	1
		1-3,5-18,20-29,32-35	2
13	13	1-35	2
14	13	1-35	2
14	14	33	1
		1-32,34-36	2
15	14	1-21,23-26,28-36	2
		22,27	3
16	14	24-26,35,36	1
		1-23,27-34	2
16	15	3,10,11,14,23-25,29-33	1
		1,2,4-9,12,13,15-22,26-28,34-36	2
17	14	1,12,13,24,25,36	1
		2,3,10,11,14,15,22,23,26,27,34,35	2
17	15	4-9,16-22,27-34	1
		1-3,10-15,23-26,35,36	2
18	14	1,27	1
		2,3,10-15,22-26,34-36	2
18	15	4-10,15-18	1
		1-2,11-14,19,21-25,30-32	2
		3,20,26-29,33-36	3

HENRY MOUNTAINS

T.	R.	Section	Rank
27	9	1-36	1
30	9	25,32-36	3
		19-24,26-31	4
30	10	20-29,32-36	1
		19,30,31	3
31	8	1,7,12,13,18,19,24,25,30,31,36	3
		2-6,8-11,14-17,20-23,26-29,32-35	4
31	9	4-9,16-21,28-33	3
32	8	30,31	2
		1,6,7,10-15,18,20-29,33-36	3
		2-5,8,9,16,17,19,32	4
32	9	1,12,13,24,25,35,36	1
		2-11,14-23,26-34	3
33	8	6-8,12-14,17-20,22-36	2
		1-4,9-11,15,16	3
		5,21	4
33	9	1-3,9-17,20-28,34-36	1
		7,18,19,29-32	2
		4-6,8,33	3
34	8	1-3,10-13,15	2
		14	3
34	9	3	1
		2,5-11,13,14,16-19	2
		1,4,12,15,20-24,26-28	3
		25,29-36	4
34	10	1-23,26-30,32-34,36	2
		24,25,35	3
		31	4

Kaiparowits Plateau

T.	R.	Section	Rank
33	1	26,27,34-36	1
		28,33	2
		19-25,29-32	3
33	2	28,31-33	1
		19-21,29-33	3
34	1	1-3,10-14,24	1
		4-9,15-23,25-36	2
34	2	4-7,17,18,20,21,28,29	1
		8,9,16,19,30-33	2
35	2W	3-10,18-19	1

Kaiparowits Plateau (Continued)

T.	R.	Section	Rank
35	1	1-34	2
		35-36	3
35	2	4-9,16-20,25	2
		21-24,26-36	3
35	3	30-32	2
		19-29,33-36	3
36	3W	1-3,10-12,14,15	2
		13	4
36	2W	1-6,8-12	3
		7,13-18,22-27,34-36	4
36	1W	36	1
		1,24-26,35	2
		2-23,27-34	3
36	1	4-9,19-36	2
		1-3,10-18	3
36	2	30,31	2
		1-29,32-36	3
36	3	5,8,17,20,21,27,28,33-35	2
		1-4,6,7,9-16,18,19,22-26,29-32,36	3
37	1W	1,2,11-14,23-26,35,36	2
		3-10,15-22,27-34	3
37	1	1-36	2
37	2	6,7,12,13,17-20,24,25,29-32,36	2
		1-5,8-11,14-16,21-23,26-28,33-35	3
37	3	1,2,6-9,12,15-23,25-36	2
		3-5,10,11,13,14,24	3
37	4	20,21,28-33	2
		19	3
38	1W	1-3,11-14	2
		4-10,15-18	3
38	1	1-18,22-27,34-36	2
38	2	17	1
		1,4-9,12,13,16,18-21,24,25,28-33,35	2
38	3	1-36	2
38	4	2-36	2
		1	4
38	5	19-22,26-36	2
		23-25	4
39	1	1-18,22-27,34-36	2
39	2	1,2,4-9,11-20,22-36	2
		3,10,21	3
39	3	1-36	2
39	4	1-36	2
39	5	1-36	2
40	2	1-36	2
40	3	1-36	2
40	4	1-36	2
40	5	1-36	2
40	6	4-9,16-21,28-33	2
41	2	1-30	2
		31-36	3
41	3	31-36	1
		1-21,29,30	2
		22-28	3
41	4	31-36	1
		1-17,20-28	2
		18,19,29,30	3
41	5	31-33	1
		1-9,11-14,18,23-26,35,36	2
		10,15-17,19-22,27-30,34	4
42	1W	13-36	1
		4,9	2
		1-3,5-8,10-12	4
42	3	1-36	1
42	4	1-36	1
42	5	2-36	1
		1	2
43	3	1-11,14-18	1
		12,13	4

Wasatch Plateau North

T.	R.	Section	Rank
12	6	1-26,29,31,34-36	1
		27,28,30,32,33	2
12	7	1-15,17-36	3
		16	3
12	8	1-36	1
13	6	1,2,5-8,10,13,17-20	1
		3,4,9,11,12,14-16,21-36	2
13	7	1-4,9-17,19,22-26,31,32,35,36	1
		5-8,10,20,21,27-30,33,34	2

Wasatch Plateau North (Continued)

T.	R.	Section
14	6	28-33
		1-27,34-36
14	7	1,4-6,9,12,13,16
		2,3,7,8,10,11,14,15,17-36
15	6	4-6,10-15,22-24
		1-3,7-9,16-21,25-36
15	7	32-36
		1-31
15	8	9,15,20-22,27-29,32,33
		1-8,10-14,16-19,23-26,30,31,34
16	6	11,13,14,16,20-26,28,29,31-33,36
		1-10,12,15,17-19,27,30,34
16	7	1-5,9-16,21-28,34-36
		6-8,17-20,29-33
16	8	1-3,10,15,23,36
		1-3,5,6,8,10-16,22-27,32-36
17	6	4-9,11-14,16-22,24-35
		1-3,10,15,23,36
17	7	1,2,7,12,18,19,25,30
		3-6,8-11,13-17,20-24,26-29,31-36
17	8	5,6,16,19
		4,7-9,17,18,20,21,28-33
18	6	1-3,10,11,13-15,22-27,34-36
		12
18	7	4,5,7-11,13-17,19-27,29-32,34-36
		1-3,6,12,18,28,33
19	6	1-3,10-15,22-27,34-36
19	7	1-3,5,23,27-34
		4,24-26,35,36

Wasatch Plateau South

T.	R.	Section
20	5	20-29,31-36
		19,30
20	6	19-36
21	4	1-3,10-15,19-36
		4-9,16-18
21	5	1-36
21	6	4-9,16-21,28-33
22	3	1-3,10-15,22-27,34-36
22	4	1-4,9-16,21-28,33-36
		5-8,17-20,29-32
22	5	1-20,22-24,29-30
		21,25-28,31-36
23	3	1,12,13
		2,3,10,11,14,15,22-27
		34-36
23	4	2-4,6-11,14-18,20-29,31-36
		1,5,12,13,19,30
24	4	2,4-9,16-18
		1,3,10-15

This Table represents a summation of work published in 1977 as a "Ranking of Wildlife Values on Federal Coal Lands". Robert W. Scott performed the work as a Division of Wildlife Resources employee under contract (No. 14-16-006-3125) for the U.S. Fish and Wildlife Service. Scott's procedure ranked habitat use areas as critical, high-priority, substantial and limited value for selected individual species of high interest. After which the individual values were evaluated per legal section of land and a cumulative value was determined.

UMC 783.20; FISH AND WILDLIFE RESOURCE INFORMATION  
ANDALEX RESOURCES INC., CENTENIAL MINING PROJECT

General Wildlife Resource Information--All Species of Vertebrate Wildlife

The mine plan area encompasses a portion of the West Tavaputs Plateau in Carbon County, Utah. This area drains into Hayes Wash which is tributary of the Price River, which flows into the Green River and ultimately into the Colorado River at a point upstream from Lake Powell. Generally speaking, the West Tavaputs Plateau is encompassed by cold desert (upper Sonoran life zone), submontane (Transition life zone) and montane (Canadian life zone) ecological associations. These life zones could be inhabited on occasion and during different seasons of the year by about 364 species of vertebrate wildlife--20 fish species, 5 amphibian species, 15 reptile species, 244 bird species and 80 mammal species. It is interesting to note that 84 percent of these species are protected.

The mine plan area itself is represented by the Transition and Canadian life zones and provides habitat for approximately 184 species of wildlife--no fish species, 3 amphibian species, 15 reptile species, 106 bird species and 60 mammal species. Forty-seven of these species are of high interest to the State of Utah.

The Division Publication No. 78-16 "Species List of Vertebrate Wildlife that Inhabit Southeastern Utah" is appended (Appendix A) to this report since it represents a low level of study for the wildlife species listed. It identifies those species having potential to inhabit the region as well as those inhabiting the environs of the mine plan area. Appendix A also identifies which species are considered to be of high interest for the habitats and local area represented.

High interest wildlife are defined as all game species; any economically important species; and any species of special aesthetic, scientific or educational

significance. This definition would include all federally listed, threatened and endangered species of wildlife.

A ranking and display of wildlife habitats and use areas relative to high interest species of vertebrate wildlife has been developed (Table 1 and 2 and the attached map). Critical wildlife use areas followed in respective importance by high-priority, substantial value and limited value wildlife use areas require various levels of protection from man's activities and developments. Wildlife habitats and use areas ranked as being of critical or high-priority value to wildlife should be protected from surface disturbance, subsidence impacts and human or industrial disturbance. This can be accomplished through development and implementation of a wildlife plan.

For purposes of clarification the classification of waters in Utah that will be referenced in the following narrative represents a Division of Wildlife Resources system developed and applied to all of the State's waters in 1970. The classification system determined a numerical rating for each of the stream sections or lakes within Utah. (Insofar as possible, each stream section represents an ecologically and physically uniform stream segment.) The numerical values were developed through an evaluation at each water of esthetics, availability of the water to sportsmen and production of fish. Class 1 waters are the best and Class 6 are the poorest.

Critical wildlife use areas are "sensitive use areas" necessary to sustain the existence and perpetuation of one or more species of wildlife during crucial periods in their life cycles. These areas are restricted in area and lie within high-priority wildlife use areas. All stream sections, reservoirs, lakes and ponds identified by Utah Division of Wildlife Resources as Class 1 or 2 are classified as being critical. Biological intricacies dictate that significant disturbances cannot be tolerated by the members of an ecological assemblage on critical sites. Professional opinion is that disturbance to critical use areas or habitats will result in irreversible changes in species composition and/or

biological productivity of an area.

High-priority wildlife use areas are "intensive use areas" for one or more species of wildlife. "Intensive use areas" are not restricted in area and in conjunction with limited value use areas form the substantial value distribution for a wildlife species. All stream sections, reservoirs, lakes and ponds identified by Utah Division of Wildlife Resources as Class 3 are classified as being of high-priority. In addition, wildlife use areas where surface disturbance or underground activities may result in subsidence that could interrupt underground aquifers and result in a potential for local loss of ground water and decreased flows in seeps and springs should be considered as being of high-priority to wildlife.

Substantial value wildlife use areas are "existence areas" for one or more species of wildlife. "Existence areas" represent a herd or population distribution and are formed by the merging of high-priority and limited value wildlife use areas for a species. All stream sections, reservoirs, lakes and ponds identified by Utah Division of Wildlife Resources as Class 4 are classified as being of substantial value.

Limited value wildlife use areas are "occasional use areas" for one or more species of wildlife. "Occasional use areas" are part of the substantial value wildlife use area for a species. All stream sections, reservoirs, lakes and ponds identified by Utah Division of Wildlife Resources as Class 5 or 6 are classified as being of limited value.

#### MAPPING

##### Vegetation and Wildlife Habitats

It is recommended that the Company's primary effort be placed on identifying species of vegetation in each wildlife habitat within the various wildlife use areas for purposes of reclamation. The Division does not have site specific information relative to vegetation types at the mine plan area. However, there are

seven wildlife habitats present--riparian wetlands, cliffs and tallus, sagebrush, pinion-juniper forest, shrubland, ponderosa forest (limited to just scattered trees) and spruce-fir forest. The Company should identify each of these habitat associations on appropriately scaled maps.

It is believed that if satisfactory reclamation is achieved and man's disturbance does not continue or become a factor, that most species of wildlife displaced from the mine plan area will return. Without doubt, the key to success for enhancing or restoring wildlands will be development of habitats so that the postmining condition as compared to the premining condition will have similar species, frequency and distribution of permanent plants in each vegetative type. This will allow for natural plant succession. Additionally, other habitat features that represent the various life requirements for local wildlife must be provided.

#### Wildlife Use Areas

The enclosed map displays mapable, high value use areas for high interest wildlife on or adjacent to the mine plan area. This display includes stream sections and bodies of water, if any, utilized by high interest fish species. Also displayed are known seeps, springs, wetlands and riparian zones. Note that there are high interest wildlife distributions that are so broad that they cover the entire map and therefore are not illustrated. However, all vertebrate species of high interest wildlife and their distributions are discussed in the following narrative.

#### Water

Due to demands of state and federal coal mining regulations, the Company will probably be required to identify and appropriately monitor all surface waters for potential impacts from subsidence. This information should be correlated with the wildlife use area information due to the value of water to wildlife.

## FISH AND WILDLIFE INVENTORY

### Aquatic Use Areas

#### Macrophytes, Macroinvertebrates and Fish

No perennial streams are associated with the project, thus data relative to aquatic wildlife would not be practicable for presentation in the permit application.

It is important to note that no species of fish having relative abundances so low as to have caused them to be federally listed as threatened or endangered inhabit the mine plan or adjacent areas. The endangered humpback chub, bonytail chub and Colorado squawfish inhabit the Green and Colorado Rivers. Additionally, the humpback (razorback) sucker also inhabits those rivers; it is likely that this species will one day be federally listed as threatened. It is not believed that implementation and operation of the Company's project will impact any of these species.

### Terrestrial Use Areas

#### Wildlife Habitat Types

Of the seven wildlife habitat types present on the mine plan area wetlands and riparian habitats are ranked as being of critical value to all wildlife. These critical valued habitats are normally associated with drainage bottoms (ephemeral or intermittent), or perennial streams (UMC 700.5), seeps and springs within the upper Sonoran, Transition and Canadian life zones. Cliffs and their associated tallus areas that lie within the upper Sonoran or Transition life zones are ranked as being of high-priority value to all wildlife. When compared to all other wildlife habitats the aforementioned situations are considered to represent unique habitat associations (Table 1).

Riparian and wetland areas are highly productive in terms of herbage produced and use by wildlife as compared to surrounding areas. Experience has shown that as much as 70 percent of a local wildlife population are dependent upon riparian zones. Cliffs and tallus are of special importance to many high interest wildlife.

These unique habitat types must be identified in the permit application and protected due to their high value for all wildlife.

Quantitative (acreage) and qualitative (condition, successional stage and trend) data concerning the wildlife habitats in each ecological association should be included as part of the mine permit application. It is important to note that each legal section of land represented by the mine plan and adjacent areas has been ranked as to its value for the total wildlife resource. Sections 5, 6, 7, 8, 9, 12, 17 and 18 of Township 13 South Range 11 East have each been ranked as being of high-priority value to wildlife. These rankings were developed through an analysis of cumulative values for use areas of individual wildlife species inhabiting each legal section of land (Table 2).

#### Amphibians--Species Occurrence and Use Areas

Five species of amphibians, all of which are protected, are known to inhabit the biogeographic area in which the mine plan and adjacent areas are located. It is probable that three of these species inhabit the project area. Only one species of the amphibians inhabiting the project area has been determined to be of high interest to the State of Utah (Appendix A).

The tiger salamander is a yearlong resident animal that may inhabit the project area. The substantial value use area for the adult form is represented by any moist underground site or any similar habitat such as inside rotten logs, cellars or animal burrows. Such sites can be found within any wildlife habitat extending from the cold desert (upper Sonoran life zone) through the submontane (Transition life zone) and into the montane (Canadian life zone) ecological association. The larva form, often referred to as a mud-puppy, is a gilled animal that must remain in water within the above described ecological associations. It is interesting to note that the larva may fail to transform into an adult, even after their second season, and they can breed in the larva condition.

Once the larva is transformed into the adult form the animal is primarily terrestrial. Salamanders do migrate to water in the spring for breeding and

may remain there during much of the summer. Such an intensive use area would be ranked as being of high-priority value to the animal. In September the newly transformed animals leave the water to find suitable places to spend the winter.

The tiger salamander breeds from March through June and is sexually mature after one year. The male deposits a small tent-shaped structure containing a myriad of sperm on the pool bottom. During courtship the female picks up this structure in her cloaca; then the eggs are fertilized internally before or just at the time they are laid. The eggs, singly or in small clusters, adhere to submerged vegetation; after 10 to 12 days they hatch. Obviously, a critical period for maintenance of the population is when breeding salamanders, eggs or their larva are inhabiting a water.

Post-embryonic development of a salamander's larval form progresses at a pace somewhat controlled by water temperature; in some cold waters the larva may not transform into an adult and drying up of a pool may hasten the process.

Migration to or from water usually occurs at night, during or just after a rain storm. When inhabiting terrestrial sites the tiger salamander is most active at night, particularly on rainy nights, from March through September.

Larva, when small feed on aquatic invertebrates and become predacious to the point of cannibalism when they are larger. Food items for adults include insects, earthworms and occasionally small vertebrates.

No amphibians have relative abundances that are so low to have caused the animal to be federally listed as a threatened or endangered species.

#### Reptiles--Species Occurrence and Use Areas

Fifteen species of reptiles, all of which are protected, are known to inhabit the biogeographic area in which the mine plan and adjacent areas are located. It is probable that all of these species inhabit the project area. Only one specie of the reptiles inhabiting the project area have been determined to be of high interest to the State of Utah (Appendix A).

The Utah milk snake is a yearlong resident animal of the project area. Its

substantial value use area encompasses all wildlife habitats extending from the upper Sonoran (cold desert life zone) through the submontane (Transition life zone) and into the montane (Canadian and possibly Hudsonian life zone) ecological associations. Although its use area spans a multitude of habitats, the animal is extremely secretive, mostly nocturnal and is often found inside or under rotten logs, stumps, boards, rocks or within other hiding places. At night they can be found in the open where they hunt for small rodents, lizards and other small snakes. Occasionally, the milk snake may take small birds or bird eggs.

The milk snake may live beyond twenty years and it becomes sexually mature during its third spring season. After mating, which occurs during spring or early summer when they are leaving the den, female milk snakes produce clutches which average seven eggs. The eggs are secreted in a moist warm environ and then abandoned; incubation lasts 65 to 85 days. The site where an individual snake has deposited its clutch of eggs is of critical value to maintenance of the species.

To date snake dens, which are protected and of critical value to snake populations, have not been identified on or adjacent to the project area. It is important to note that inventory for such has not been attempted. If the Company at some later time discovers a den it should be reported to the Utah Division of Wildlife Resources. If a den(s) is currently known, its location must be included with the permit application.

No reptiles have relative abundances that are so low to have caused the animal to be federally listed as a threatened or endangered species.

#### Birds--Species Occurrence and Use Areas

Two hundred forty-four species of birds, all of which are protected, are known to inhabit the biogeographic area in which the mine plan and adjacent areas are located. It is probable that one hundred six of these species inhabit the project area. Twenty-eight species of the birds inhabiting the project area

have been determined to be of high interest to the State of Utah (Appendix A).

The project and adjacent areas provides substantial valued habitat for a multitude of raptors--turkey vulture, bald and golden eagles, four species of falcons (prairie, American peregrine and arctic peregrine falcon and American kestrel), five species of hawks (goshawk, sharp-shinned, Cooper's, red-tailed and Swainson's hawks) and seven species of owls (barn, screech, flammulated, great horned, pygmy, long-eared and saw-whet owls). Many of these species are of high federal interest pursuant to 43 CFR, 3461.1 (n-1). All of these species are of high interest to the State of Utah (Appendix A).

Realistically, nesting habitat does not exist on the project or adjacent areas for most, if not all, of these species. However, if a species were to nest on or adjacent to the project area, it would have a specific crucial period during which the aerie would need protection from disturbance; this period of time lies between February 1 and August 15. Generally speaking, aerie represent a critical valued site and need protection from significant or continual disturbance within a one-half kilometer radius of the nest. This consideration need only be implemented during the period of time that the nest is occupied. Species specific protective stipulations for aeries are available from the Utah Division of Wildlife Resources and the U.S. Fish and Wildlife Service.

The current level of data relative to site specific use of the area by raptors is unsatisfactory. Likely, there are aeries that have not been identified. Many of these species are highly sensitive to man's disturbances. Therefore, it is recommended that intensive surveys be initiated on the mine plan and adjacent areas for determination of locations for raptor aerie territories. Such data needs to be merged with information provided within this report.

Golden eagles are a common yearlong resident of the mine plan area. To date no active aerie territories are known. (Note, an aerie territory is utilized by one pair of eagles but may contain several nest sites.) It is believed that aerie territories may exist on the project area. This belief is based upon

the fact that suitable nesting habitat is widespread on the mine plan area and throughout the local area.

An active golden eagle nest site is extremely sensitive to disturbance within a one-half kilometer radius. This buffer zone is ranked as being of critical value to maintenance of the eagle population when the bird is actually utilizing the aerie; that period of time is normally between April 15 and June 15. The radius for a buffer zone may need to be increased to one kilometer if a disturbance were to originate from above and within direct line of sight to the eagle aerie.

To date there are no known high-priority concentration areas or critical roost trees for golden eagles on the project area. The mine plan and adjacent areas have been ranked as being of substantial value to golden eagles.

The northern bald eagle is an endangered winter resident (November 15 to March 15) of the local area. To date there are no known high-priority concentration areas or critical roost trees for this species on or adjacent to the project. The mine plan area has been ranked as being of substantial value to wintering bald eagles. Note that no bald eagles are known to nest in Utah, however, historic data documents nesting activity by these birds in the State. There is no known historic evidence of the northern bald eagle nesting on the mine plan or adjacent areas.

The American peregrine falcon (status is endangered) and the prairie falcon (status is common) are yearlong residents of the mine plan and adjacent areas. Each of these species utilizes cliff nesting sites. To date there are no known aerie sites for cliff nesting falcons on the project area. However, suitable nesting habitat for the prairie falcon is widespread. Suitable nesting habitat for the American peregrine falcon cannot be found on the mine plan and adjacent areas. The project area has been ranked as being of substantial value to these two cliff nesting falcons.

For each falcon their aerie site while being utilized and a one-half kilo-

meter radius would be ranked as being of critical value to maintenance of their populations. The falcon's period of use at the aerie site spans the spring and early summer period--prairie falcon, April 15 to June 30; peregrine falcon, March 1 to June 30.

The level of data relative to site specific use of the project area by cliff nesting falcons (not including the kestrel) is unsatisfactory and there could be aeries that have not been identified. Therefore, it is recommended that intensive surveys be initiated on the area for determination of locations for cliff falcon aerie sites.

The endangered arctic peregrine falcon is a winter resident (November 15 through March 15) of the local area. This species has not been observed to utilize the environs on or adjacent to the mine plan area, however, its occasional presence would not be unlikely. Therefore, the project area is ranked as being of limited value to this species.

The blue grouse is a yearlong resident of the project area. Adult birds prefer open stands of conifers. During winter the blue grouse feeds exclusively upon needles and buds of douglas-fir and spruce trees. Thus, this wildlife habitat (spruce-fir forest) is ranked as being of critical value to over-winter survival of the population during the crucial period of December through February.

Blue grouse annually exhibit what has been termed a reverse vertical migration. That is, during the spring months, they migrate from the high elevation spruce-fir habitat to lower elevation sagebrush, pinion-juniper or shrubland habitats. This movement is caused by a need of the birds to feed on early developing vegetation. Such movement also facilitates successful breeding, nesting and brooding of their young. Then as the year progresses, they move to the higher elevations.

The males are polygamous and will set up and defend territories for booming and breeding activities against other breeding males. Such territories are critical to maintenance of the population during the crucial period of mid-March through mid-June.

After breeding the female develops a nest site which is secreted on the ground; the nest is of critical value to maintenance of the blue grouse population. Upon hatching, which occurs in late May and early June, the young accompanied by the hen immediately leave the nest. The young blue grouse while being brooded rely heavily on insects for their protein needs during the first several months of development. The adult bird also shifts its diet during this period to include a high proportion of insects. Brooding areas are ranked as being of high-priority value to blue grouse. The crucial period extends from hatching into mid-August.

As summer progresses into the fall season the grouse consumes large quantities of berries.

The chukar is a yearlong resident of the project area. It is important to note that they are an exotic species introduced from Asia during the 1950's. These birds prefer open rocky areas in the cold desert and submontane ecological associations. During summer chukars feed on grass shoots and insects, but during winter their diet is primarily seeds. Their substantial valued habitats are the cliff and tallus type and the associated desert scrub or shrubland types.

The winter season is a crucial period (early December through mid-February) for chukars; the birds concentrate on selected areas. Winter range has been ranked as being of critical value to over-winter survival of the chukar populations. Disturbance on winter range must be avoided when chukars are present.

Chukars are monogamous; the pairs nest between early April and late May. Nest sites are critical to maintenance of the population during the crucial nesting period.

It is important to note that all sources of water within the substantial value use area for chukars are critical to maintenance of their populations on a yearlong basis.

Mourning doves normally inhabit the project and adjacent areas, which represents a substantial valued use area for these birds, between May 1 and September

15 each year. They nest throughout most of this period and each pair produces two clutches. The pinion-juniper and riparian habitats are ranked as being of high-priority value for nesting. Locally, mourning doves show two peaks in on-nest activity--early July and early August. Successful nesting activities and any water sources are critical to maintenance of the mourning dove population.

The black swift is a summer resident of the West Tavaputs Plateau. The montane ecological association represents the swift's substantial valued use area. Normally, the bird is associated with a small flock that represents a colony. Black swifts are usually observed soaring as pairs and they feed upon flying insects. A colony's nests are scattered along precipitous terrain where the nest is often secreted behind a waterfall. Such a moist habitat is not known to exist on the project area. Cliff and tallus wildlife habitats are ranked as being of high-priority value to the black swift. There is evidence that pair bonds are long lasting and that a nest may be utilized in successive years.

The pileated woodpecker is a species having high federal interest pursuant to 43 CFR 3461.1 (n-1). The spruce-fir and aspen wildlife habitats of the montane ecological association represent this birds substantial valued use area. It is important to note that the pileated woodpecker has never been documented to utilize the environs of the biogeographic area that surrounds the project site. In areas of the State where the bird is known to exist, it is a yearlong resident with a relative abundance considered to be rare.

The Williamson's sapsucker is another species having high federal interest pursuant to 43 CFR 3461.1 (n-1). Typically, the substantial valued use area for this species is the spruce-fir habitat of the Hudsonian life zone in the montane ecological association. Therefore, the spruce-fir habitat of the Canadian life zone on the project site would only represent the substantial valued use area for the yellow-bellied sapsucker. The yellow-bellied sapsucker is a yearlong resident of the environs associated with the project area and it has a relative abundance considered to be common. Where as the Williamson's sapsucker has never

been documented to utilize the environs of the biogeographic area that surrounds the project site. In areas of the State where the Williamson's sapsucker is known to exist, it is a summer resident with a relative abundance considered to be uncommon.

The Lewis woodpecker is also another species having high federal interest pursuant to 43 CFR 3461.1 (n-1). Its substantial valued use area is represented by riparian habitats characterized by cottonwood stands and ponderosa forests. These habitats do not exist on the project site. It is important to note that the Lewis woodpecker has never been documented to utilize the environs of the biogeographic area that surrounds the project site. In areas of the State where the bird is known to exist, it is a summer resident or only a transient. Its relative abundance is unknown.

The western bluebird is an uncommon summer resident known to inhabit the environs of the biogeographic area that surrounds the project site. Where as the mountain bluebird is a common yearlong resident of the area. Both birds are cavity nesting species. The western bluebird nests from the pinion-juniper habitat of the submontane ecological association up into the lower forest habitats within the Canadian life zone of the montane ecological association. The mountain bluebird utilizes the same continuum of habitats for nesting, but also extends its nesting use across the Canadian and Hudsonian life zones and into the Alpine life zone. During winter both species show elevational and longitudinal migrations; they then utilize all habitats associated with the cold desert ecological association. Therefore, the substantial valued use area for each species spans a broad continuum of habitats. It is important to note that trees with cavities located on the project area can be of critical value to bluebirds.

Grace's warbler is a species having high federal interest pursuant to 43 CFR 3461.1 (n-1). Its substantial valued use area is shrublands and associated ponderosa forest habitats of the submontane and montane ecological associations. This bird's nest is built twenty or more feet above ground in a ponderosa tree.

It is important to note that the Grace's warbler has never been documented to utilize the environs of the biogeographic area that surrounds the project site. In areas of the State where it is known to exist, it is a summer resident with a relative abundance considered to be uncommon.

Scott's oriole is also a species having high federal interest pursuant to 43 CFR 3461.1 (n-1). Its substantial valued use areas are riparian habitats characterized by cottonwood stands and the continuum of habitats extending from the pinion-juniper forest into shrublands of the submontane ecological association. The oriole's nest is characterized as a grassy pouch and is hung in a tree. It is important to note that the Scott's oriole has never been documented to utilize the environs of the biogeographic area that surrounds the project site. In areas of the State where it is known to exist, it is a summer resident with a relative abundance considered to be uncommon.

The grasshopper sparrow is a rare transient species known to inhabit the environs of the biogeographic area that surrounds the project site. It only frequents dry grassland areas in the desert scrub habitat of the cold desert ecological association during spring and fall migration periods; the project borders such areas. Since its use of such sites is best described as "occasional", those habitats in the region are only ranked as being of limited value to the bird.

#### Mammals--Species Occurrence and Use Areas

Eighty species of mammals, of which 22 percent are protected, are known to inhabit the biogeographic area in which the project and adjacent areas are located. It is probable that sixty of these species inhabit the project area. Seventeen species of the mammals inhabiting the project area have been determined to be of high interest to the State of Utah (Appendix A).

The dwarf (least) shrew is a yearlong inhabitant of the biogeographic area that surrounds the project site. This animal's substantial valued use area is characterized as open grass covered areas of any wildlife habitat in the submontane and montane (Canadian life zone) ecological associations. Since this

shrew has a relative abundance determined to be limited, its use areas should be ranked as being of high-priority value to the animal.

The red bat is a summer resident of the biogeographic area that surrounds project site. The animal roosts in wooded areas (riparian woods and pinion-juniper forests) of the submontane ecological association. Such areas represent this animal's substantial valued use area. An occasional individual has been known to utilize caves; those individuals could hibernate and remain over winter.

The western big-eared bat is a yearlong resident of the biogeographic area that surrounds the project site. This animal roosts and hibernates within caves, mine tunnels or suitable buildings located in the pinion-juniper, shrubland and low elevation spruce-fir habitats of the submontane and montane (Canadian life zone) ecological association. Such areas represent this bat's substantial valued use area.

The cottontail rabbit (mountain cottontail inhabits sites lying between 7,000 and 9,000 feet in elevation and the desert cottontail inhabits sites lower than 7,000 feet in elevation) is a yearlong resident of the biogeographic area that surrounds the project site. The entire project area represents a substantial valued use area for cottontails. Their young are born between April and July. This is a crucial period for maintenance of the cottontail population.

The red fox and kit fox are yearlong inhabitants of the biogeographic area that surrounds the project site. The substantial valued use area for the red fox would include all wildlife habitats extending from the cold desert through the montane (Canadian life zone) ecological associations. The substantial valued use area for the kit fox is restricted to all of the habitats of the cold desert ecological association and extends into the sagebrush and pinion-juniper habitats of the submontane ecological association. Almost nothing is known of their population dynamics. Without doubt a crucial period for both species is when they are caring for young in the den. Dens while being inhabited are a critical use area.

The gray wolf is a historic inhabitant of the biogeographic area that surrounds the project site. Currently its relative abundance is so low that the animal is listed as endangered with extinction. The wolf's substantial valued use area would be represented by any remote habitat in any ecological association.

Black bears are inhabitants of the biogeographic area that surrounds the project site. Their substantial valued use area is represented by all natural wildlife habitats (excluding the pasture and fields and urban or park types) extending from the submontane into the montane (Canadian and Hudsonian life zones) ecological associations. These animals go into a semi-hibernation during winter. During this crucial period, which may last from December through March, the animal secretes itself in a den in order to conserve body energy reserves. The young are born in the den during January or February. Dens while being inhabited represent a critical valued use area for bears.

The wolverine and badger are the only members of the family mustelidae having potential to inhabit the biogeographic area that surrounds the project site. They are protected and classified as furbearers.

The substantial valued use area for wolverine is the montane ecological association. This specie may be found in the environs of the project site.

The substantial valued use area for badger spans all wildlife habitats other than dense forests in the cold desert, submontane and montane (Canadian life zone) ecological associations. They are dependent upon a suitable prey source.

A crucial period for maintenance of all furbearer populations is when they have young in a den. Such sites are critical for reproductive success.

Bobcat and cougar are known to inhabit the biogeographic area that surrounds the project site. For both of these species a crucial period for maintenance of their population is when the female has her young secreted at a den site. Such sites are of critical value when being utilized. It is also crucial to their survival that a female accompanied by young not be killed or harassed.

The substantial valued use area for bobcats extends from the cold desert through the submontane and into the montane (Canadian life zone) ecological association. The bobcat is normally associated with precipitous terrain, but has been observed in every wildlife habitat within the aforementioned ecological associations. Their primary prey source is represented by small mammals and birds or any other small animal they can catch. It is important to note that bobcats occasionally do kill the young of big game animals.

The substantial valued use area for the cougar (locally known as mountain lion) extends from the submontane into the montane (Canadian and Hudsonian life zone) ecological association. Due to the dependency of the cougar upon mule deer as a prey source, a ranking of the lion's seasonal distribution parallels that of the deer.

Mule deer are inhabitants of the biogeographic area that surrounds the project site. Their substantial valued use area spans all wildlife habitats extending from the cold desert through the submontane and montane ecological associations. In some situations deer show altitudinal migrations in response to winter conditions. There are, however, habitats where deer reside on a yearlong basis.

Migration of mule deer from summer range to winter range is initiated during late October; probably, the annual disturbance of the fall hunting season coupled with changing weather conditions is the initial stimulus. The onset of winter weather reinforces the deer's urge to migrate and continued adverse weather keeps the deer on the winter range.

The project site represents winter range for mule deer herd unit 27b. Winter ranges for mule deer are all ranked as being of high-priority value to the animal; these areas are usually inhabited between November 1 and May 15 each year. During winters with severe conditions the higher elevation portion of the winter range becomes unavailable to deer due to snow depth. Traditionally, some restricted portions of the winter range have shown concentrated use by the deer; these sites are ranked as being of critical value. Critical valued sites must be protected from man's disturbance when the deer are physically present on the

range (see attached map).

Deer begin their migration back to summer range during mid-May and remain there throughout October. There are no summer ranges on the project area.

Mule deer fawn during the month of June. The continuum of wildlife habitats extending from the pinion-juniper through the shrubland and into the aspen type probably represents the fawning area. All riparian areas are of critical value for fawning and maintenance of the deer population. To date no specific areas showing annual use for fawning are known. It is probable that such areas exist; they would be ranked as being of critical value to deer. It is important to note that June represents a crucial period for maintenance of deer populations.

Rocky mountain elk are inhabitants of the biogeographic area that surrounds the project site. Their substantial valued use area spans all wildlife habitats extending from the submontane through the montane ecological association. Elk do not show as strong of altitudinal migration as mule deer do in response to winter conditions, but they do migrate to wintering areas.

Migration of elk from summer range to winter range is initiated during late October; probably, the annual disturbance of the fall hunting seasons coupled with changing weather conditions is the initial stimulus. The onset of winter weather reinforces the elk's urge to migrate and continued adverse weather keeps elk on the winter range.

The project site represents winter range for the Avintiquin elk herd. Winter ranges for elk are ranked as being of either high-priority or limited value to the animal; these areas are usually inhabited between November 1 and May 15 each year (see attached map).

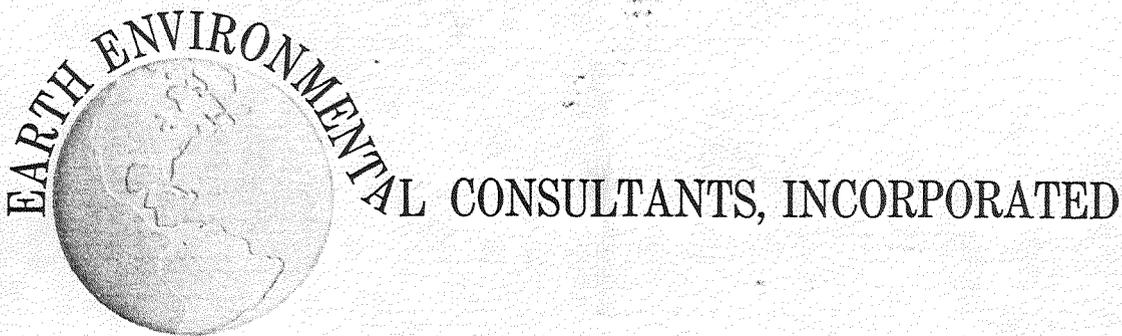
During winters with severe conditions some portions of the winter range becomes unavailable to elk due to snow depth. High-priority valued sites need to be protected from man's disturbance when the elk are physically present on the range.

Elk begin their migration back to summer range during mid-May and remain

there throughout October. There are no summer ranges for elk on the project area.

Elk calf during the month of June, but no animals would be expected to calf on the project area.

Currently, there are no other known high interest wildlife species or their habitat use areas on or adjacent to the project area. It is not unreasonable to suspect that in the future, some additional species of wildlife may become of high interest to the local area, Utah or the Nation. If such is the case, the required periodic updates of project permits and reclamation plans can be adjusted and appropriate recommendations made.



SOIL SURVEY AND VEGETATION INVENTORY  
OF THE PROPOSED SUNNYSIDE MINE SITE AND  
EXTENSION OF THE PINNACLE MINE SITE

PRICE, UTAH

PREPARED FOR:

AMCA COAL LEASING, INC.

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EARTH ENVIRONMENTAL CONSULTANTS, INC.

ALBUQUERQUE, NEW MEXICO

SEPTEMBER, 1981

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RESOURCE EVALUATION · PLANNING · ENGINEERING

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SOIL SURVEY AND VEGETATION INVENTORY  
OF THE PROPOSED SUNNYSIDE MINE SITE AND  
EXTENSION OF THE PINNACLE MINE SITE

INTRODUCTION, HISTORY AND SUMMARY

The proposed Sunnyside Mine Site and extension of the Pinnacle Mine Site are located in Deadman Canyon in North Central Carbon County, Utah. The two areas are separated by about 1,200 feet distance, which makes up the present Pinnacle Mine Site located in Section 7, T.13S., R11E., SLBM. The Sunnyside Mine Site joins the existing Pinnacle Mine Site on the north and extends northward up Deadman Canyon for approximately 1,700 feet and contains 12.50 acres. The proposed extension of the Pinnacle Mine Site joins the existing Pinnacle Mine Site on the south and extends southward down Deadman Canyon for approximately 1,100 feet and contains 8.16 acres.

The Pinnacle Mine Site was surveyed in May of 1980 by George Cook and Gary Moreau, both with the USDA Soil Conservation Service. Both a soil survey and vegetation survey were conducted and a report was prepared. The area covered by the Cook-Moreau report (Pinnacle Mine Site) was not a part of this study; however, it should be noted that some of the same soils and same range sites were encountered in this study. The soil testing and vegetation data gathered in this report should be directly applicable to the same soils and range sites occurring on the Pinnacle Mine Site before disturbance; and the reclamation interpretations and/or recommendations should be the same.

Earth Environmental Consultants, Inc., (EECI) was retained by AMCA Coal Leasing, Inc. (AMCA) to conduct the soil and vegetation inventories in July, 1981. Prior to commencement of field investigations, representatives of EECI and AMCA met with representatives of Utah's Department of Oil, Gas and Minerals (DOGGM) for explicit instructions

and guidelines for conducting the studies. The major part of the field work was done during the week of July 20, 1981 by Dellon N. Cox (Soil Scientist) and Lamar Mason (Range Conservationist). Due to misdirections concerning the sample adequacy formula by DOGM, a few additional samples were gathered by Mr. Mason, the first week in September, 1981.

The soil survey (Order 1) and the detailed vegetation inventory, along with their respective maps, are presented in the following separate sections. In summary, only two soil series with their representative ecological plant communities (range sites) were encountered. The two soils were Brycan bouldery loam occurring on 8 to 20 percent slopes, which represents the mountain stony loam (oak) range site; and Datino very stony loam on 15 to 35 percent slopes, representing the upland stony loam (P-J) range site. In addition, areas of Brycan soils that had been disturbed through road construction or related mining activities were mapped separately, as well as approximately one-half acre of rock outcrop occurring in the proposed Pinnacle Mine Site extension. Due to a large amount of disturbance in the proposed extension of the Pinnacle Mine Site areas, it was impossible to gather meaningful vegetative data in that area. This was discussed with DOGM representatives at the time of the field investigation and it was concluded that since the same soils occurred in both the proposed Sunnyside Mine Site area and the proposed extension of the Pinnacle Mine Site area, the representative vegetative data gathered on the Sunnyside Site would be sufficient and directly applicable to the Pinnacle Extension Site.

The vegetation existing on the Brycan soil, Mountain Stony Loam (Oak) was found to be producing 61 percent of its potential and was determined to be in good ecological condition. The vegetation existing on the Datino soil, Upland Stony Loam (P-J) was found to be producing 32 percent of its potential and was determined to be in fair ecological condition.

## SOIL SURVEY

This survey was conducted according to the National Cooperative Soil Survey guidelines. The intensity of mapping qualifies as an Order 1 soil survey. Each soil boundary was visually investigated along its entire length. The soils are shown on the soils map. Each soil is identified with a two letter symbol and the distribution and extent are denoted by the soil boundary lines on the map. All areas having the same symbol are essentially the same kind of soil. The soils are named but have not been correlated.

### SOIL LEGEND

<u>Soil Symbol</u>	<u>Soil Map Unit Name</u>	<u>Acres</u>	
		<u>1/</u>	<u>2/</u>
Ba	Brycan bouldery loam, 8 to 20 percent slopes	8.21	0.90
Bd	Brycan soil disturbed	0.40	4.86
Da	Datino very stony loam, 15 to 35 percent slopes	3.89	1.95
R0	Rock outcrop, 50 to 100 percent slopes	--	<u>0.45</u>
Total Acres		12.50	8.16

1/ Sunnyside Area

2/ Pinnacle Mine Extension Area

### DESCRIPTION OF THE SOILS

Ba Brycan bouldery loam, 8 to 20 percent slopes

This soil is very deep and is well drained. It occurs in the bottoms of canyons and on alluvial fans at the foot of very steep mountain slopes at elevations of 2,150 to 2,165 meters (7,050 to 7,100 feet). This soil is formed in alluvium derived mainly from sandstone and shale.

The average annual precipitation is 30 to 41 centimeters (12 to 16 inches). The mean annual air temperature is 6 to 7 degrees centigrade (43 to 45 degrees F.). The average frost-free season is 100 to 110 days.

Slopes are 8 to 20 percent. They are concave, east and west facing and are short in length.

Vegetation is that described as the Mountain Stony Loam (oak) range site in the following section. Most visible is the fairly dense gamble oak and bigtooth maple.

Included in mapping are small areas of Datino soils along the upper margins and small areas of a soil identical in all characteristics except it contains more rock fragments throughout the soil profile than is allowed for the Brycan series.

In a typical profile, the surface layer is grayish brown bouldery loam about 28 centimeters (11 inches) thick. The underlying layer is brown bouldery sandy loam about 38 centimeters (15 inches) thick. The next layer is pale brown sandy clay loam about 35 centimeters (14 inches) thick. The next layer is light brownish gray light clay loam (31 percent clay) about 35 centimeters (14 inches) thick. The next layer is pale brown loam about 35 centimeters (14 inches) thick. This soil has thick layers of buried surface layers.

Permeability is moderate. Available water capacity is about 28 centimeters (11 inches) to a depth of 1.5 meters (60 inches). Organic matter content of the surface, and in some buried layers, is about 3 percent. Effective rooting depth is about 1.5 meters (60 inches). Surface runoff is slow and erosion hazard is slight under native vegetation, and moderate if vegetation is removed. Erodibility is moderate. This soil is used for grazing of livestock and wildlife habitat.

The taxonomic classification of this soil is fine-loamy, mixed, Cumulic Haploborolls.

A typical pedon of Brycan bouldery loam, 8 to 20 percent slope was described near the north boundary of the Sunnyside Area, about 7.5 meters (25 feet) west of the drainage bottom. (See soils map for exact location.)

A11---0 to 28 centimeters (0 to 11 inches); grayish brown (10YR 5/2) bouldery loam; very dark grayish brown (10YR 3/2) moist; moderate, medium platy structure; soft, very friable, slightly sticky, slightly plastic; many fine and medium roots, many fine interstitial pores; about 10 percent boulders; slightly effervescent, mildly alkaline (pH 7.65 in saturated paste); clear wavy boundary. (10 to 35 centimeters thick)

A12---28 to 66 centimeters (11 to 26 inches) brown (10YR 5/3) bouldery sandy loam, dark brown (10YR 3/3) moist; moderate fine granular structure; soft, very friable, slightly sticky, slightly plastic; many fine and medium roots, many fine interstitial pores; about 10 percent stones and boulders; slightly effervescent, neutral (pH 7.37 in saturated paste); clear wavy boundary. (30 to 50 centimeters thick)

C1---66 to 102 centimeters (26 to 40 inches) pale brown (10YR 6/3) sandy clay loam, dark brown (10YR 3/3) moist; moderate medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; many fine roots; many fine interstitial pores; few fine gravel; strongly effervescent, moderately alkaline (pH 7.87 in saturated paste); clear wavy boundary. (30 to 40 centimeters thick)

C2---102 to 137 centimeters (40 to 54 inches) light brownish gray (10YR 6/2) light clay loam (31 percent clay), dark grayish brown (10YR 4/2) moist; weak medium subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; many fine and medium roots; many fine interstitial pores; 15 percent sandstone gravel; strongly effervescent with many threadlike lime segregations, moderately alkaline (pH 8.11 in saturated paste); clear wavy boundary. (30 to 40 centimeters thick)

C3----137 to 173 centimeters (54 to 68 inches) pale brown (10YR 6/3) loam, brown (10YR 4/3) moist; weak medium sub-angular blocky structure; slightly hard, friable, sticky and plastic; many fine and medium roots; many fine interstitial pores; few gravel; strongly effervescent, moderately alkaline (pH 8.23 in saturated paste).

Another typical pedon of Brycan bouldery loam, 8 to 20 percent slopes, was described in the Pinnacle Mine Site extension area about 202 meters (675 feet) south and 60 meters (200 feet) east of the north  $\frac{1}{4}$  corner marker section 18, T.13S., R.11E. (See soils map for exact location.)

A11---0 to 18 centimeters (0 to 7 inches) grayish brown (10YR 5/2) bouldery loam, very dark grayish brown (10YR 3/2) moist; moderate thin platy parting to moderate fine granular structure; soft, very friable, slightly sticky, slightly plastic; many fine and medium roots; many fine and very fine interstitial and tubular pores; 10 percent boulders, 25 percent gravel; noneffervescent, neutral (pH 7.0); clear wavy boundary. (10 to 25 centimeters thick)

A12---18 to 33 centimeters (7 to 13 inches) grayish brown (10YR 5/2) gravelly loam, very dark brown (10YR 2/2) moist; weak fine granular structure; slightly hard, very friable, slightly sticky, slightly plastic; many fine and medium roots; many very fine interstitial and tubular pores; 15 percent gravel; noneffervescent, neutral (pH 7.0); clear wavy boundary. (10 to 20 centimeters thick)

C1----33 to 61 centimeters (13 to 24 inches) brown (10YR 5/3) gravelly loam, very dark grayish brown (10YR 3/2) moist; weak medium subangular blocky structure; hard, friable, slightly sticky, slightly plastic; many fine

and medium roots; many fine interstitial and tubular pores; 15 percent gravel, 5 percent cobble; slightly effervescent, lime coatings on undersides of gravel, mildly alkaline (pH 7.8); gradual wavy boundary. (23 to 35 centimeters thick)

C2----61 to 109 centimeters (24 to 43 inches) brown (10YR 5/3) gravelly loam, dark brown (10YR 4/3) moist; weak medium subangular blocky structure; hard, friable, slightly sticky, slightly plastic; many fine and medium roots; many fine interstitial and tubular pores; 15 percent gravel; strongly effervescent, lime coatings on all sides of gravel, moderately alkaline (pH 8.2); gradual wavy boundary. (40 to 60 centimeters thick)

C3----109 to 153 centimeters (43 to 60 inches) light brown (7.5YR 6/4) gravelly loam, dark brown (7.5YR 4/4) moist; massive; hard, friable, slightly sticky, slightly plastic; many fine and medium roots; many fine interstitial and tubular pores; 15 percent gravel, 10 percent cobble; strongly effervescent, moderately alkaline (pH 8.2).

#### Bd Brycan soils disturbed

This soil is the same in all characteristics as the Ba Brycan bouldery loam, except it has been physically disturbed by earth moving equipment in roadbed preparation and other related mining activities. It is devoid of vegetation and contains the major haul roads and facility locations. Many of the pedons are truncated while others have thick depositions of surface materials.

#### Da Datino very stony loam, 15 to 35 percent slopes

This soil is very deep and well drained. It occurs on alluvial fans at the toeslope of very steep mountain sideslopes at elevations of 2,160 to 2,175 meters (7,100 to 7,150 feet). This soil formed in coluvium and alluvium derived mainly from sandstone and shale.

The average annual precipitation is 30 to 41 centimeters (12 to 16 inches). The mean annual air temperature is 6 to 7 degrees centigrade (43 to 45 degrees F.). The average frost-free season is 100 to 110 days.

Slopes are 15 to 35 percent and are mainly east facing. They are short in length and are mainly concave.

Vegetation is that described for the Upland Stony Loam (P-J) in the vegetation section of this report. Most visible is the dominance of pinyon and juniper trees in rather open stands with sagebrush and salina wildrye grass.

In a typical profile, the surface layer is grayish brown very stony sandy loam about 28 centimeters (11 inches) thick. The underlying layer is pale brown very cobbly loam about 18 centimeters (7 inches) thick. The next layer is pale brown very cobbly silt loam or sandy loam about 107 centimeters (42 inches) thick.

Permeability is moderate. Available water capacity is 10 to 15 centimeters (4 to 6 inches) to a depth of 1.5 meters (60 inches). Organic matter content in the surface layer is about 2.5 percent. Effective rooting depth is about 1.5 meters (60 inches). Surface runoff is slow and erosion hazard is slight under native vegetation, and moderate if vegetation is removed. Erodibility is low. This soil is used for grazing of livestock and wildlife habitat.

The taxonomic classification of this soil is loamy-skeletal, mixed, Typic Haploborolls.

A typical pedon of Datino very stony loam, 15 to 35 percent slopes was described about 120 meters (400 feet) north of the south boundary of the Sunnyside Mine Site area about 15 meters (50 feet) west of the drainage bottom. (See soils map for exact location.)

A1----0 to 28 centimeters (0 to 11 inches) grayish brown (10YR 5/2) very stony sandy loam, very dark grayish brown (10YR 3/2) moist; moderate thin platy parting to moderate fine granular structure; soft, very friable, nonsticky, nonplastic; many fine and very fine roots; many fine interstitial pores; 20 percent stones, 15 percent cobble, 10 percent gravel; noneffervescent, neutral (pH 7.0); clear wavy boundary. (25 to 35 centimeters thick)

B2----28 to 46 centimeters (11 to 18 inches) pale brown (10YR 6/3) very cobbly loam, dark brown (10YR 3/3) moist; moderate fine subangular blocky structure; hard, very friable, slightly sticky, slightly plastic; many fine and medium roots; many fine interstitial pores; 20 percent cobble, 15 percent gravel, 5 percent stones; weakly effervescent, neutral (pH 7.2); clear wavy boundary. (13 to 23 centimeters thick)

C1ca--46 to 153 centimeters (18 to 60 inches) pale brown (10YR 6/3) very cobbly silt loam, brown (10YR 4/3) moist; massive; hard, friable, slightly sticky, slightly plastic; many fine and medium roots; many fine interstitial pores; 25 percent cobble, 20 percent gravel, 15 percent stones; strongly effervescent, moderately alkaline (pH 8.2).

Another typifying pedon of Datino very stony sandy loam was described approximately 225 meters (750 feet) due south of the north  $\frac{1}{4}$  corner marker, section 18, T.13S., R.11E. in the Pinnacle Mine Site extension area. (See soils map for exact location.)

A11---0 to 10 centimeters (0 to 4 inches) grayish brown (10YR 5/2) very stony sandy loam, very dark brown (10YR 2/2) moist; moderate thin platy structure; very friable, nonsticky, nonplastic; many fine and medium roots; many very fine interstitial and tubular pores; 15 percent gravel, 5 percent cobble, 5 percent stones; noneffervescent, neutral (pH 7.2); clear wavy boundary. (7 to 15 centimeters thick)

A12---10 to 33 centimeters (4 to 13 inches) grayish brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) moist; moderate fine granular structure; soft, very friable, slightly sticky, slightly plastic; many fine and medium roots; many very fine interstitial and tubular pores; 25 percent gravel, 5 percent cobble; noneffervescent, neutral (pH 7.2); clear wavy boundary. (16 to 30 centimeters thick)

B2----33 to 51 centimeters (14 to 20 inches) pale brown (10YR 6/3) gravelly loam, brown (10YR 4/3) moist; moderate fine subangular blocky structure; slightly hard, friable, slightly sticky, slightly plastic; many fine and medium roots; many very fine interstitial and tubular pores; 15 percent gravel, 10 percent cobble, 5 percent stones; weakly effervescent; mildly alkaline (pH 7.8); abrupt smooth boundary. (10 to 20 centimeters thick)

C1ca--51 to 66 centimeters (20 to 26 inches) pale brown (10YR 6/3) very gravelly sandy loam, brown (10YR 4/3) moist; massive; hard, friable, slightly sticky, slightly plastic; many fine and medium roots; many fine interstitial and tubular pores; 30 percent gravel, 5 percent cobble, 5

5 percent stones; strongly effervescent, moderately alkaline (pH 8.2); abrupt smooth boundary. (30 to 45 centimeters thick)

C2ca--66 to 92 centimeters (26 to 36 inches) very pale brown (10YR 7/3) gravelly sandy loam, brown (10YR 4/3) moist; weak fine subangular blocky structure; hard, friable, slightly sticky, slightly plastic; many fine and medium roots; many fine interstitial and tubular pores; 10 percent gravel, 5 percent cobble; strongly effervescent, moderately alkaline (pH 8.2); abrupt smooth boundary. (20 to 30 centimeters thick)

C3ca--92 to 153 centimeters (36 to 60 inches) pale brown (10YR 6/3) very gravelly sandy loam, brown (10YR 4/3) moist; massive; hard, friable, nonsticky, nonplastic; many fine and medium roots; many fine interstitial and tubular pores; 25 percent gravel, 10 percent cobble, 10 percent stones; strongly effervescent; moderately alkaline (pH 8.2). (50 or more centimeters thick)

R0 Rock outcrop, 50 to 100 percent slopes

This land type occurs only in the Pinnacle Mine Site extension area. It occurs as a rock face on an extremely steep canyon side facing west. It consists mainly of sandstone with a few thin layers of shale. It is essentially devoid of vegetation; consequently has no associated range site. Permeability is essentially zero. Runoff is very high and erosion hazard is very slight (hard rock). This land type is used for aesthetics and watershed.

It has no taxonomic classification; that is, it is classified as Not Soil; consequently, it has no water or nutrient-holding capacity and no effective rooting depth.

## SOIL INTERPRETATIONS

The Brycan and Datino soils were sampled for laboratory testing in the Sunnyside Mine Site area. Also selected for laboratory testing were: one sample from the existing Pinnacle Mine Site topsoil storage pile (not shown on map); one sample of mine spoil material from a small area included in the disturbed Brycan soil in the proposed extension of the Pinnacle Mine Site area; two surface samples of disturbed Brycan soils in the proposed extension of the Pinnacle Mine Site, one designated as southcentral, the other as southwest. The resulting data are shown in the following table, LABORATORY DATA FOR SOIL SAMPLES.

As can be interpreted from the data, all soils tested have very favorable physical and chemical characteristics for plant growth media. All samples were nonsaline, as exhibited by the low electrical conductivities (EC mmhos/cm); they are nonsodic, as evidenced by the very low Sodium Adsorption Ratio (SAR). Excluding the large boulders on the surface of the Brycan soil and the stones, gravel and cobble in the Datino soil, the remaining soil material has very favorable water and nutrient capacities, and have very favorable textures, ranging from sandy loam to light clay loam or sandy clay loam; that is, with 19.2 percent to 31.4 percent clay. The low levels of Boron and Selenium (B and Se) indicate that toxicity from these elements is not a problem. The same is true of the heavy metals, molybdenum (Mo), arsenic (As), and lead (Pb). The micronutrient elements of copper (Cu), iron (Fe), zinc (Zn) and manganese (Mn) have sufficient quantities for proper plant growth without creating toxicities. The relatively high amounts of organic matter (OM) enhance the favorability of the soil materials for water and nutrient-supplying capabilities. The amounts of major fertilizer elements of potassium (K) is moderate, phosphorus (P) is low, but adequate, and nitrogen (N) is moderately low, but adequate (estimated from OM). Consequently, no application of fertilizers are recommended with the following exceptions: where mulch is used in the reclamation process, 20 pounds of available nitrogen per ton of mulch should be applied. After plants are established, if they show signs of

LABORATORY DATA FOR SOIL SAMPLES

Series	Sample #	Depth (in.)	mmhos/cm <sup>1/</sup> EC	pH <sup>2/</sup>	-----meq/100 gm <sup>3/</sup> ----- --Extractable cations--				-----meq/l <sup>4/</sup> ----- ----soluble cations----				
					Na	Ca	Mg	K	Na	Ca	Mg	K	
Brycan	A11	1	0-11	.499	7.65	.02	14.12	1.40	.37	.11	3.33	1.37	.26
	A12	2	11-26	.464	7.37	.02	9.36	1.20	.33	.09	3.06	1.07	.32
	C1	3	26-40	.464	7.87	.01	9.59	1.67	.31	.11	3.04	1.31	.33
	C2	4	40-54	.486	8.11	.03	11.51	3.14	.40	.07	3.58	1.16	.32
	C3	5	54-68	.546	8.23	.02	7.75	3.24	.37	.24	3.60	1.21	.47
Datino	A1	1	0-11	.509	7.80	.02	8.75	1.66	.49	.12	2.92	1.61	.41
	B2	2	11-18	.410	7.94	.02	6.98	1.60	.48	.16	2.52	1.04	.55
	C1ca	3	18-60	.303	7.98	.02	7.21	1.06	.22	.09	2.05	.64	.26
Pinnacle	South West	0-10	1.24	7.98	.15	7.67	5.38	.25	2.02	7.92	1.18	.26	
	Top Soil	0-10	.559	8.07	.02	10.75	1.38	.32	.19	3.83	1.18	.23	
	Spoil	0-10	.875	8.20	.05	13.95	7.00	.43	.63	5.34	2.59	.36	
	South Central	0-10	1.00	8.18	.06	8.98	5.18	.48	.69	6.72	2.22	.32	

Series	Sample #	Depth (in.)	% CaCO <sub>3</sub>	-----ppm----- -----Micronutrients-----						% H <sub>2</sub> O <sup>6/</sup>	% O.M. <sup>7/</sup>
				Mo	Pb	Cu	Fe	Zn	Mn		
Brycan	1	0-11	5.0	<1.0	.4	.62	8.94	1.24	7.04	39.0	3.39
	2	11-26	5.5	<1.0	<.2	.70	4.38	.80	6.50	28.4	1.38
	3	26-40	14.9	<1.0	<.2	.76	2.66	.52	4.60	31.0	1.41
	4	40-54	14.9	<1.0	<.2	.74	2.28	.92	4.34	35.8	2.91
	5	54-68	14.9	<1.0	<.2	.86	2.38	.58	5.14	30.8	1.03
Datino	1	0-11	.4	<1.0	<.2	.38	6.08	1.42	7.32	34.6	2.41
	2	11-18	.4	<1.0	<.2	1.12	3.94	.68	4.60	28.9	1.03
	3	18-60	7.2	<1.0	<.2	.90	2.32	.92	4.26	29.8	.93
Pinnacle	South West	0-10	5.6	<1.0	<.2	.56	4.98	.40	2.26	27.4	2.80
	Top soil	0-10	7.0	<1.0	1.0	.50	6.20	1.22	4.90	33.5	5.06
	Spoil	0-10	7.5	<1.0	.6	.74	7.24	1.76	5.62	31.5	2.37
	South Central	0-10	6.9	<1.0	<.2	.70	5.32	.88	3.52	28.7	1.65

LABORATORY DATA FOR SOIL SAMPLES (Cont'd.)

Series	Sample #	Depth (in.)	----- 8/ -----			Texture	ppm K <u>9/</u>	mg/l As <u>10/</u>	ppm P <u>10/</u>
			% Sand	% Silt	% Clay				
Brycan	1	0-11	49.4	29.4	21.2	Loam	82	<.2	5.1
	2	11-26	53.2	27.6	19.2	Sandy loam	119	<.2	2.9
	3	26-40	43.2	29.6	27.2	Sandy clay loam	43	<.2	2.6
	4	40-54	33.2	35.4	31.4	Clay loam	133	<.2	4.6
	5	54-68	39.8	37.6	22.6	Loam	86	<.2	2.6
Datino	1	0-11	61.4	21.8	16.8	Sandy loam	123	<.2	7.4
	2	11-18	43.6	33.6	22.8	Loam	168	<.2	2.1
	3	18-60	21.6	55.8	22.6	Silt loam	49	<.2	2.1
Pinnacle	South West	0-10	57.0	21.6	21.4	Sandy clay loam	41	<.2	2.9
	Top Soil	0-10	55.4	25.4	19.2	Sandy loam	96	<.2	4.6
	Spill	0-10	35.2	35.6	29.2	Loam	90	<.2	5.4
	South Cental	10-10	51.6	25.2	23.2	Sandy clay loam	100	<.2	4.6

LABORATORY DATA FOR SOIL SAMPLES (Cont'd.)

Series	Sample #	Depth (in.)	-----mg/l-----		12/ SAR	
			B	11/ Se		
Brycan	A11	1	0-11	.54	<.2	.07
	A12	2	11-26	.32	<.2	.06
	C1	3	26-40	.27	<.2	.07
	C2	4	40-54	.35	<.2	.04
	C3	5	54-68	.30	<.2	.15
Datino	A1	1	0-11	.59	<.2	.08
	B2	2	11-18	.35	<.2	.12
	C1ca	3	18-60	.22	<.2	.08
Pinnacle	South West		0-10	.32	<.2	.95
	Top Soil		0-10	.59	<.2	.12
	Spoil		0-10	.80	<.2	.31
	South Central		0-10	.51	<.2	.33

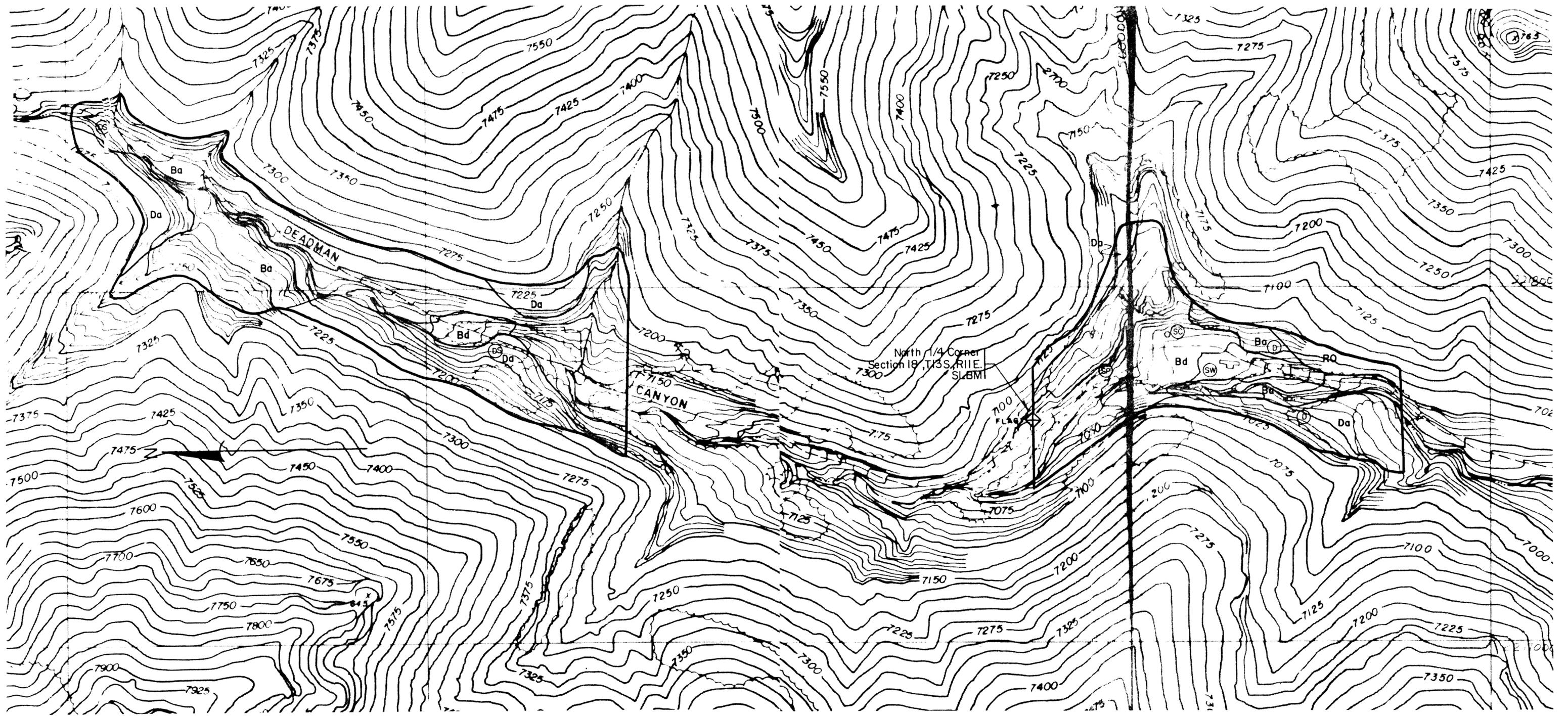
- 1/ Solution Conductivity
- 2/ Saturated Paste
- 3/ Ammonium Acetate Extraction at pH 9.0
- 4/ Paste Extract
- 5/ DPTA Extraction
- 6/ Drying at 105°C.
- 7/ Walkley-Black
- 8/ Hydrometer
- 9/ Ammonium Acetate Extraction
- 10/ Sodium Bicarbonate Extraction
- 11/ Hot Water Extraction
- 12/  $\frac{Na^+}{\sqrt{\frac{Ca^{++} + Mg^{++}}{2}}}$

Tests conducted by New Mexico State University Soil and Water Testing Laboratory, Las Cruces, New Mexico.

of phosphorus or nitrogen deficiencies, applications can be made at that time, based on plant needs.

Even though all the soil materials are favorable for plant growth, the surface soils of the Brycan and Datino are more favorable than the substratums, due to a higher concentration of calcium carbonate ( $\text{CaCO}_3$  or lime) in the lower horizons, and a higher concentration of rock fragments in the lower horizons of the Datino soil.

In conclusion, the only major limitations of the soils existing at both sites is the large surface boulders on the Brycan soil, surface stones on the Datino soil, as well as large amounts of rock fragments in the lower horizons of the Datino soil. It is recommended that the large stones and boulders be pushed to the lowest part of the topography and covered with surface soils wherever possible, and that surface soils be replaced to a minimum depth of one foot in disturbed areas, wherever possible, before starting seeding operations.



**SOIL MAP**



**LEGEND**

- Ba Brycan bouldery loam, 8 to 20 percent slopes
- Bd Brycan soil disturbed
- Da Datino very stony loam, 15 to 35 percent slopes
- RO Rock outcrop, 50 to 100 percent slopes
- (D) Soil description & sample site
- (D) Soil description site
- (SW) (SP) (SC) Soil sample site

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## VEGETATION

The vegetative portion of this inventory includes a map of the range site and condition of the study area. The range sites are the standard range sites (climax ecological plant communities) used by the Soil Conservation Service and the Bureau of Land Management in their range inventory systems. Present vegetation (range condition) was inventoried on July 20, 21, 22, 1981 by Lamar Mason, with the assistance of Allen Emmel and Dellon Cox. The vegetative inventory includes cover, production, species diversity and density of woody species (numbers of plants per acre).

Production data was gathered by use of the double sampling method, supplemented by 1/10-acre transects to get production for trees and large shrubs, including Gambel oak, Utah juniper, pinyon pine, Rockymountain juniper, and bigtooth maple. Randomization in sampling was achieved by selection of line of direction for the belt transects by use of 16 cardinal compass directions. A starting point was selected by going to the farthest north point of the delineation for both range sites. A rock was thrown backwards over the shoulder to determine point of beginning. Samples had previously been drawn from a hat to determine line of direction for the belt transect for the first 100 feet (1/100 acre). The belt transect was 4.356 feet wide and 100 feet long for each sample. At the end of each 100-foot belt transect, a 9.6 square foot plot location was selected at random. A previously drawn direction sample (16 cardinal compass points) was drawn from a hat. To coincide with this, a number (1 to 50 or 1 to 100) was drawn from a hat. The 9.6 square foot plot was located by going the specified line of direction drawn for the number of feet drawn. This same randomized system was used on each of ten, one hundred-foot belt transects and ten-9.6 square foot plots (see TABLES 2 and 2a). Additional 9.6 square foot plots needed (determined by formula) were located by drawing line of direction and numbers for distance from a hat (TABLES 2 and 2a) If a direction and distance was drawn that occurred outside the site, the selection was excluded and the next one was used. These additional plots were located by randomization, as indicated on TABLES 2 and 2a.

## PRODUCTION DETERMINATIONS

Procedures for determining production were to take measurements of tree species and large shrubs from the belt transect. The measurements correlated to production have been previously confirmed by computer and use as accurate by Soil Conservation Service and other agencies. These tables are TABLE N, Gambel oakbrush, yield table for Mountain Stony loam range site, TABLE A, Guide for Determining current yield of Utah Juniper in Utah, TABLE B, Pinyon Pine Yields, annual yield per tree, pounds air-dry for pinyon pine, and TABLE J, Gambel oakbrush yield table. TABLE N was used to determine yield of Gambel oak and bigtooth maple, on Mountain Stony loam range site and TABLE J for Gambel oakbrush yield on Upland Stony loam (P-J). Each clump of oak and maple was measured. The foliage width and length were taken and the width multiplied by the length to determine foliage area. The average diameter of stems was measured at the ground line for each clump and the basal area determined by computing the stem area multiplied by the number of stems in the clump. The yield in pounds air-dry was then taken from TABLES N and J by following the foliage area on the left hand column and going across to the applicable basal area column, indicated across the top of the table. Yield of Utah juniper and pinyon pine are correlated with crown diameter of each tree and relative denseness of the foliage. Crown spread was measured on the belt transects and record made of whether the foliage was sparse, medium, or dense. Production was found in TABLES A and B by finding the weight (air-dry) per tree opposite the crown diameter in the sparse, medium, or dense section of the table.

The production of all other species, other than Gambel oak, bigtooth maple, Utah juniper, pinyon pine, and Rockymountain juniper were taken by use of the double sampling method on the 9.6 square foot plots. This was done by taking sample weight units of each species on areas outside the plots. These sample weight units were then used as a base for estimating the gram weights of each species on each plot. After 10 plots were estimated, 2

plots were selected and all species on these plots were weighed in grams. The plot numbers of clipped plots were circled (TABLE 1 and 1a). Species with significant production not found on the clipped plots were clipped from one of the other plots. These are circled in the body of the table. A correction factor was calculated by dividing estimated weight into actual weight. The corrected weights were then computed by multiplying estimated weight by the correction factor.

A sample of each species was weighed green and dried, to air-dry (3 weeks). Percent air-dry was then determined by dividing dry weight by green weight. Dry weight was then determined on TABLE 1 and 1a by multiplying total green weight for each species by percent dry weight (taken from TABLE 20). Average dry weight per plot was then calculated and multiplied by 10 to give pounds per acre air-dry. The 9.6 square foot plot is designed so that weights in grams multiplied by 10 on each plot gives pounds per acre or a total summation of 10 plots converts directly to pounds per acre. The green weight of the 5 tree and large shrub species were included on TABLES 1 and 1a, to give total vegetative yields by converting pounds per acre, taken from the belt transects, to grams per plot and doubling the dry weight to give green weight (most species were found to be near 50 percent dry weight). The first 100 feet transect was included with Plot 1 (on TABLES 1 and 1a), the second 100 feet with Plot 2, etc. For all plots taken on the Upland Stony Loam (P-J) site over the first 10 plots, the average grams per plot from the first 10 were recorded for the 5 species on the extra plots determined as needed by formula. The percent composition by air-dry weight was calculated for each species by dividing dry weight of each by the total dry weight. All data for production is included on TABLE 1 for the Mountain Stony Loam (oak) range site and on TABLE 1a for Upland Stony Loam (pinyon-juniper) range site.

After 10 plots, with supplemental yield data from the belt transects were taken, the number of additional plots needed were calculated. The formula:

$$n = \frac{(t \text{ value})^2 S^2}{[(\bar{X}) (\% \text{ change})]^2}$$

was used for this calculation. See TABLES 3 and 3a. These calculations indicated the need for only 0.69 plot on the Mountain stony loam (oak) site and 19.45 on the Upland stony loam (Pinyon-juniper) site. So 10 plots of yield data were taken on the former site and 20 on the latter, with 2 additional clipped plots on the latter.

#### COVER DETERMINATIONS

Vegetative cover by species was determined on the same plots where production data was taken. It was measured by use of a tape measure, graduated in tenths of feet. The crown spread area of each plant was measured on each plot and recorded to the nearest .1 of a square foot. Litter cover, rock surface, and bare ground were also recorded in square feet on each plot on the first 10 plots.

The formula for number of samples needed was calculated and it was thus determined that 20 plots are needed on Mountain stony loam (oak) site (TABLE 8) and 46 (minimum of 40) on the Upland stony loam (Pinyon-Juniper) site (TABLE 16). In addition to the first ten, 10 more plots were taken on the Mountain stony loam (oak) site and 30 more on the Upland stony loam (Pinyon-Juniper). See TABLES 7 and 15.

#### SPECIES DIVERSITY

Species diversity can be interpreted by weight and by cover. This data will be shown in summary in the interpretations section of this report.

#### DENSITY

Density of woody species was taken by using the point-quarter method. This information was taken at the locations where the production plots were taken, except where additional plots were needed, and these were taken at locations indicated on TABLES 2 and 2a.

After the distances were recorded in the northeast, northwest, southwest, and southeast quadrats, to the nearest woody species, the mean distance was calculated at each plot location. The formula for the required plots was calculated and determined that 31 (minimum of 40) was needed on the Mountain stony loam (oak) site (TABLE 11) and 27 on the Upland stony loam (Pinyon-Juniper) site (TABLE 18). After the data from these additional locations were taken, the mean distance on the Mountain stony loam (oak) site was determined to be 4.15 feet (see TABLE 9). The total density of woody species was then calculated by use of the formula:

$$\text{Total density} = \frac{\text{Unit Area}}{(\text{mean point-to-plant distance})^2} = \frac{43,560}{(4.15)^2} = \frac{43,560}{17.22} = 2,530 \text{ individuals per acre}$$

On the Upland stony loam (P-J) site, the mean distance is 7.8, which calculates to 716 individuals per acre (TABLE 17).

In addition to the total woody species calculations by the point-quarter method, this method was used on individual woody species on the first ten plots of each site. This data is included as TABLE 10 for the Mountain stony loam (oak) site on 8 woody species and as TABLE 21 on 7 woody species on the Upland stony loam (P-J) site.

#### SPECIES LISTS

Species lists, TABLES 12 and 19, are included for each of the two range sites. This includes the plant code, scientific name, and common name for each plant species. The list is broken down into three groups; grasses, forbs, and shrubs and trees.

#### INTERPRETATIONS

Two range sites occur in this study area, with very small areas of an additional site making up less than 1/10 of an acre total. These two sites

are Mountain stony loam (oak) and Upland stony loam (pinyon-juniper).

The Mountain stony loam (oak) range site is described as follows:

Mountain Stony Loam (oak)

This site occurs on alluvial fans on the study area, near the Pinnacle Mine site. Elevation is about 2,165 meters (7,100 feet). Slopes are 15 to 25 percent and east facing. Average annual precipitation is 30 to 41 centimeters (12 to 16 inches). Frost-free season is 100 to 110 days.

This range site relates to the Ba, Brycan Soil.

Present Vegetation: The inventory of the Mountain stony loam (oak) range site shows the following plant species and percentage of air-dry weight.

PRESENT PLANT COMMUNITY--MOUNTAIN STONY LOAM (OAK)

<u>Grasses and Grass-Like</u>	<u>Percent</u>
Kentucky bluegrass	4
Sedge	4
<u>Forbs</u>	
Aster	1
Louisiana sagewort	3
Lupine	3
Stansbury phlox	1
Starry-false-Solomons-Seal	1
Goldenrod	5
<u>Trees and Shrubs</u>	
Bigtooth maple	10
Gambel oak	43
Mountain snowberry	9
Rocky mountain juniper	2
Gooseberry currant	3
Woods Rose	1
Douglas fir	T*
Myrtle pachystima	3
Oregon-grape	2
Serviceberry	2

T = trace (less than 1% by weight). The above percent composition by weight, compared with other species in the list, indicates species diversity by weight.

Total annual production is 795 pounds per acre air dry in the 1981 growing season.

POTENTIAL PLANT COMMUNITY--MOUNTAIN STONY LOAM (OAK)

<u>Species</u>	<u>Percent Composition by Weight</u>
<u>Grasses and Grass-Like Plants</u>	
Beardless bluebunch wheatgrass	5
Salina wildrye	15
Muttongrass	10
Carex	5
Western wheatgrass	5
Slender wheatgrass	5
Mountain brome	5
Stipa (3 species)	5
<u>Forbs</u>	
Aster	1
Louisiana sagewort	5
Lupine	5
Phlox	1
Goldenrod	5
Others	5
<u>Shrubs and Trees</u>	
Gambel oak	25
Mountain snowberry	5
Birchleaf mountainmohogany	5
Big sagebrush	5
Antelope bitterbrush	5
Rocky mountain juniper	1
Bigtooth maple	5
Serviceberry	2
Myrtle pachystima	2
Total Potential Yield	1700 pounds per acre favorable 1200 pounds per acre average 650 pounds per acre unfavorable

Considering the above as climax or potential, the present vegetation is 61 percent of potential. This is determined to be good ecological condition.

Upland Stony Loam (Pinyon-Juniper) Woodland Site

This site occurs on alluvial fans and very steep mountain slopes at the study area near the Pinnacle Mine. Elevations range from 2,160 to 2,225

meters (7,100 to 7,300 feet). Slopes are 15 to 65 percent, and east, south, and north facing.

Climate is cold, snowy winters, and warm dry summers. Average annual precipitation is from 30 to 41 centimeters (12 to 16 inches), with approximately 20 to 40 percent occurring during the plant growth period, April to October. Plant growth begins from March 15 to April 15, and grasses and forbs mature June 15 to July 1. Frost-free period is 100 to 110 days.

This woodland site relates to the Da, Datino Soil.

Present Vegetation: An inventory of the Upland stony loam (pinyon-juniper) woodland site recorded the following plant species and percentage of air-dry weight.

PRESENT PLANT COMMUNITY--UPLAND STONY LOAM (P-J)

<u>Grass and Grass-Like</u>	<u>Percent</u>
Blue grama	2
Indian ricegrass	2
Salina wildrye	12
<u>Forbs</u>	
Louisiana sagewort	2
Hairy goldaster	2
<u>Trees and Shrubs</u>	
Big sagebrush	5
Black sagebrush	1
Plains pricklypear	1
Green Mormontea	1
Pinyon pine	20
Utah juniper	39
Mountain snowberry	1
Fineleaf yucca	2
Douglas rabbitbrush	1
Gambel oak	9

Total annual production is 1,252 pounds per acre air dry. The above percent for each species, compared with all the other plants, indicates plant diversity by weight.

Potential Vegetation: Potential vegetation is an overstory of Utah juniper and pinyon pine, with an overstory density of 20 to 25 percent. Composition by annual weight is 25 percent juniper pinyon, 45 percent grasses, about 10 percent forbs, and 20 percent shrubs.

The following table lists the potential plant community for the Upland stony loam (pinyon-juniper) woodland site. Those species occurring at higher percentages of air-dry weight constitute more important species for the site.

POTENTIAL PLANT COMMUNITY--UPLAND STONY LOAM (P-J)

<u>Species</u>	<u>Canopy Class</u> Sparse 10-25% %/wt.
<u>Grasses and Grass-Like</u>	
Bluebunch wheatgrass	40
Bottlebrush squirreltail	1
Indian ricegrass	8
Muttongrass	10
Needleandthread	5
Nevada bluegrass	10
Sandberg bluegrass	1
Western wheatgrass	1
<u>Forbs</u>	
Aster	1
Daisy	1
Eriogonum	1
Blue flax	1
Goldenrod	3
Mustard	1
Phlox	2
Sego lily	1
Tapertip hawksbeard	5
<u>Shrubs and Trees</u>	
Antelope bitterbrush	2
Big sagebrush	15
Birchleaf mountainmahogany	1
Black sagebrush	10
Eriogonum	1
Mormontea	1

POTENTIAL PLANT COMMUNITY--UPLAND STONY LOAM (P-J) (Cont'd.)

Species	Canopy Class
Species	Sparse 10-25% %/wt
Pinyon pine	*2 10
Pricklypear	1
Rock goldenrod	2
Utah juniper	*4 15

\* Production below 1.37 meters (4.5 feet) in height

Potential yields for a sparse canopy class of the Upland stony loam (pinyon-juniper) woodland site are shown in the following table. This yield data is based on 10 plots in excellent condition, 111 plots in good, 75 plots in fair, and 73 plots in poor condition.

TOTAL POTENTIAL ANNUAL PRODUCTION OF VEGETATION

For Sparse Canopy Class  
Upland Stony Loam (P-J)

	Total All Vegetation Kg/Ha	Total All Vegetation Lbs/Ac	Total Below 1.37m(4.5 ft.) Kg/Ha	Total Below 1.37m(4.5 ft.) Lbs/Ac
Favorable Years	1,800	1,600	1,650	1,475
Average Years	1,200	1,075	1,125	1,000
Unfavorable Years	825	725	750	675

On the basis of the above potential, the present vegetation is 32 percent of the potential for the site. This is determined to be fair ecological condition.

Interpretations of the cover on these two sites indicate that in present condition, the Mountain stony loam (oak) site has a total vegetation cover of 58 percent, with 26 percent litter, 7 percent bare rock, and 9 percent bare ground.

TABLE 1

## MOUNTAIN STONY LOAM (OAK) PRODUCTION DETERMINATIONS

Species	Plots										Total Estimated Weight	Actual Weight Clipped Plots	Correction Factor	Corrected Green Weights	Percent Dry Weight	Total Dry Weight	Average Dry Weight/Plot	Pounds Per Acre	Percent Composition
	1	2	3	4	5	6	7	8	9	10									
AGTR		2									2		100	2	50	1	T	1	T
CAREX			7			3	7	33			50	44	110	55	53	29	T	29	4
KOCR								2			2	2	100	2	48	1	T	1	T
POFE						17		24			41	27	112	46	56	26	T	26	3
POPR		1	2		20					22	46	28	117	54	57	30	T	30	4
POSE							1				1		100	1	100	1	T	1	T
TOTAL GRASSES																88		88	11
ASTER			10	6							16	9	90	14	50	7	1	7	1
ARLU						5	12	30		4	51	27	90	46	53	24	2	24	3
ERIGE2			3								3	3	100	3	50	2	T	2	T
LUPIN										35	35	37	106	37	54	20	2	20	3
PHST2			1	1		5					7	1	100	7	100	4	T	4	1
SMST	10										10	10	100	10	70	7	1	7	1
SOLID				24	10		12	34	13		93	30	88	82	48	39	4	39	5
TRDU									2		2		100	2	57	1	T	1	T
TOTAL FORBS																104		104	14
ACGR3	72	54	T	T	12				8		146	*8	100	146	50	83	8	83	10
AMAL2			34								34	31	91	31	55	17	2	17	2
BERE						42					42	39	93	39	49	19	2	19	2
JUOS								4	1		5	**4	100	5	50	2	T	2	T
JUSC2	5		5	10		4		8			32	**8	100	32	50	16	2	16	2
PAMY	30	15									45	14	93	42	57	24	2	24	3
PIED									6		6	6	100	6	50	3	T	3	T
QUGA	10	43	82	90	107	64	88	15	38	134	671	*97	100	671	50	336	34	336	43
RIMO2			44								44	40	91	40	50	20	2	20	3
ROWQU	15	5									20	14	93	19	43	8	1	8	1
SYOR2			8	40		25	40			52	6		88	150	50	75	8	75	9
TOTAL SHRUBS																603		603	75
TOTAL	142	164	152	171	149	165	160	158	169	145						795		795	100

\*COMPUTED FROM TABLES FOR OAKBRUSH (GAMBEL OAK)

\*\*COMPUTED FROM TABLES FOR UTAH JUNIPER

TABLE 1A

UPLAND STONY LOAM (PINYON - JUNIPER) RANGE SITE  
 PRODUCTION DETERMINATIONS

Species	Plots																				Total Estimated Weight	Actual Weight Clipped Plots	Correction Factor	Corrected Green Weights	Percent Dry Weight	Total Dry Weight	Average Dry Weight/Plot	Pounds Per Acre	Composition Percent									
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20																		
ELSA	60		45	32		40	28	30	62		14	110	75	2	20	12	20		16	26	592	17	91	538	59	317	16	160	12									
ORHY	5	3			42	1		17		18											118	63	105	124	47	58	3	30	2									
BOGR2						4								33	2		14				60	45	112	68	67	46	2	20	2									
CAREX									4	3					17						17	20	118	20	53	11	0.5	5	T									
TOTAL GRASSES																																		215	16			
ARLU	4		8	45					2		7	3					48	7		124	11	82	102	53	54	3	30	2										
CHV16		7					1				2		22	27			2			61	34	117	72	50	36	2	20	2										
ASD15				5					1											6	1	100	6	47	3	20	2	T										
ARAB12					2													1		3		100	3	47	1	0.1	1	T										
TOTAL FORBS																																				52	4	
JUQS*	76	92	76		126	230	88	104	144	46	98	98	98	98	98	98	98	98	98	1,962	*	100	1,962	50	981	49	490	39										
PIED	2	80	2		10	44	196	28	44	92	50	50	50	50	50	50	50	50	50	998	*	100	998	50	499	25	250	20										
QUGA*			30	76	5		88	20			22	22	22	22	22	22	22	22	22	439	*	100	439	50	219	11	110	9										
EPV1															15					15	17	113	17	47	8	0.4	4	T										
SYO2	36				12					12					10					58	32	89	52	50	26	1	10	1										
ARTR2			35				34							5						19	12	100	19	100**	19	1	10	1										
ARARN	3	70	2		7	5		1	35			25			4	70		34	24	74	34	91	67	100**	67	3	30	2										
CHV18			8		22			1	18				40							280	31	89	249	47	117	6	60	5										
CHNAZ																		1		40	35	88	35	47	16	1	10	1										
																				50	13	68	34	50	17	1	10	1										
																				4		100	4	47	2	0.1	1	T										
TOTAL SHRUBS																																					985	79
TOTAL	186	252	206	165	295	340	405	234	258	207	211	287	272	269	243	213	276	253	229	229											1,252	99						

\*Taken on belt transects from measurements and tables J, A and B.  
 \*\*Research shows annual weight air dry as 15% of green weight of leaves and pads.  
 This was computed in the field and dry weight recorded directly.

TABLE 2

RANDOMIZATION - MOUNTAIN STONY LOAM (OAK)

	<u>Transect Direction</u>	<u>Plot No.</u>	<u>Plot Direction</u>	<u>Distance</u>
ACGR2	SSW	1	NE	72
JUSC	S	2	W	48
JUOS	SW	3	WSW	63
Taken on	SW	4	ESE	29
1/100 acre	SSW	5	SW	4
plots 4.356	SW	6	WNW	42
wide & 100'	WSW	7	NE	25
long on	WSW	8	E	11
this	SE	9	NNW	9
transect	SSW	10	NW	37
	SSE	11	ENE	34
No info.	SW	12	W	23
taken on trees	SE	13	N	45
and shrubs	SSW	14	WSW	36
but	SW	15	NNW	8
transect run	SSW	16	WSW	40
to help loc-	SW	17	WNW	3
ate and rand-	S	18	WSW	18
omize 9.6 sq.	ESE	19	S	33
ft. plots	SW	20	NNE	14
		21	ESE	7
		22	NW	19
		23	WNW	44
		24	SE	32
		25	SW	26
		26	N	99
Starting for		27	NNE	27
31 to 35,		28	N	41
17 ft. SSE		29	NW	77
of station		30	NE	37
18		31	WNW	18
		32	ENE	43
		33	W	96
		34	WSW	21
		35	NE	73
Start 36 to		36	NW	31
40, 40' ft.		37	SSE	66
SE station		38	WNW	46
12		39	ESE	28
		40	NNW	93

Starting point for plots 21 to 30 drawn by distance & cardinal direction & from station #7 on transect drawn from hat. Direction NNW distance 87 ft.

TABLE 2a

## RANDOMIZATION-UPLAND STONY LOAM (P-J)

<u>Transect Direction</u>	<u>Plot No.</u>	<u>Plot Direction</u>	<u>Distance</u>
SW	1	E	17
SSE	2	NNE	43
WSW	3	N	11
SSW	4	S	27
SE	5	SSW	19
SSW	6	ENE	34
WSW	7	ESE	30
S	8	WSW	3
ENE	9	SW	12
NNE	10	NE	44
Start 11 NE station 4, 43 ft. -	11	ENE	29
	12	W	18
	13	N	49
	14	NNE	15
	15	SE	35
Start 16, WNW from station 2, 27 ft.-	16	NW	22
	17	ESE	9
	18	NNE	22
	19	NE	38
	20	S	5
Start 21, S from station 8, 16 ft. -	21	SSW	27
	22	WSW	17
	23	NNW	33
	24	SE	7
	25	WNW	46
Start 26 SW from station 6, 9 ft. -	26	E	24
	27	NNW	6
	28	ENE	14
	29	N	40
	30	NW	7
Start 31 48 ft. ENE, station 1 --	31	SSE	14
	32	SW	28
	33	NNE	46
Start 36 34 ft. NW, station 9 -	34	SW	9
	35	SSW	46
	36	NE	18
	37	N	41
	38	WNW	20
	39	S	34
	40	NE	16

TABLE 3

## MOUNTAIN STONY LOAM (OAK) PRODUCTION DATA

Calculation of Number of Plots Needed

$$n = \frac{(t \text{ value})^2 S^2}{[\bar{x} (\% \text{ change})]^2}$$

$$n = \frac{1.81^2 \times 171-142 = \frac{29}{4} = 7.25^2}{[157.5 (.1)]^2}$$

$$n = \frac{3.27 \times 52.56}{248.06}$$

$$n = 0.69$$

So 10 plots are adequate

NOTE: Information received from Susan Linner (by telephone) after this table was completed, indicated that it was not necessary to complete the formula for numbers of plots on production data.

TABLE 3A

## UPLAND STONY LOAM (PINYON-JUNIPER) PRODUCTION DATA

Calculation of Number of Samples Needed

$$n = \frac{(t \text{ value})^2 S^2}{[\bar{x} (\% \text{ change})]^2}$$

$$n = \frac{(1.81)^2 (60.0)^2}{[246 (.1)]^2}$$

$$n = \frac{3.27 \times 3600.00}{605.16}$$

$$n = \frac{11772.00}{605.16}$$

$$n = 19.45$$

NOTE: Information received from Susan Linner (by telephone) after this table was completed, that it was not necessary to complete the formula for numbers of plots on production data. We ran production on 10 more plots than needed.

TABLE 4  
MOUNTAIN STONY LOAM (OAK)  
BIG TOOTH MAPLE

Station	Foliage		Area (ft. <sup>2</sup> )	Average Diameter (in.)	Average Area	Number of Stems	Basal Area (in. <sup>2</sup> )	Pounds Air-Dry	Height (ft.)	
	W. ft.	L. ft.								
1+00 (SSW)	8.0	10.0	80	6.0	28.26	1	28.26	2.38	17.0	
	3.0	5.0	15	0.5	.196	3	.57	.24	3.0	
	1.5	4.0	6	0.7	.385	1	.38	.15	3.5	
	4.0	5.0	20	0.3	.07	3	.21	.10	3.5	
	3.0	3.0	9	7.0	69.86	1	69.86	2.07	10.0	
	4.0	5.0	20	3.0	7.07	1	7.07	.69	19.0	
	2.0	3.0	6	0.4	.12	2	.24	.07	2.0	
	2.0	3.0	6	1.3	1.33	1	1.33	.19	6.0	
	3.0	5.0	15	0.3	.07	6	.42	.24	2.0	
	3.0	4.0	12	3.5	9.62	1	9.62	.62	11.0	
	3.0	3.0	9	0.3	.07	7	.49	.19	3.0	
	5.0	8.0	40	1.5	1.77	6	10.62	.34	12.0	
	TOTAL							7.28		
	2+00 (WSW)	3.0	4.0	12	0.4	.12	4	.48	.22	4.0
5.0		5.0	25	1.8	2.54	3	7.62	.77	15.0	
2.0		3.0	6	0.5	.19	4	.76	.19	2.0	
4.0		4.0	16	2.5	4.91	6	29.46	1.57	17.0	
2.0		3.0	6	3.2	8.04	1	8.04	.39	15.0	
2.0		4.0	8	0.5	.19	6	1.14	.22	3.5	
3.0		5.0	15	3.7	10.75	1	10.75	.70	20.0	
2.0		2.0	4	2.8	6.16	1	6.16	.28	12.0	
2.0		3.0	6	4.2	13.5	1	13.5	.48	13.0	
1.0		1.0	1	2.5	4.91	1	4.91	.14	10.0	
2.0		5.0	10	0.2	.03	12	.36	.20	1.0	
1.0		3.0	3	1.8	2.54	4	10.16	.29	12.0	
TOTAL								5.45		
3+00 (SW)								0		
4+00 (SW)	1.0	2.0	2	0.2	.03	5	.15	.02	1.0	
5+00 (SSW)	2.0	6.0	10	1.6	2.0	8	16.0	.66	8.0	
	3.0	3.0	9	2.2	-3.8	1	3.8	.37	12.0	
	3.0	3.0	9	0.3	.07	10	.7	.19	3.0	
TOTAL							1.22			
6+00 (SW)							0			
7+00 (WSW)							0			
8+00	3.0	3.0	9	.1	.008	11	.09	.02	1.0	
	2.0	4.0	8	1.2	1.13	5	5.65	.41	9.0	
	2.0	3.0	6	0.2	.03	8	.24	.07	2.0	
	1.0	1.0	1	1.0	.78	1	.78	.08	5.0	
	1.0	3.0	3	1.3	1.33	2	2.66	.18	7.0	
TOTAL							.76			
9+00							0			
10+00							0			

TABLE 4a  
 UPLAND STONY LOAM (PINYON-JUNIPER)  
 Dry Weight-Utah Juniper

Station	Crown Spread	Denseness	Height	Pounds	Total/100'
1 + 00 (SW)	7.0	S	7.5	1.9	3.8
	6.0	M	8.0	1.9	
2 + 00(WSW)	10.0	M	12.0	4.6	4.6
3 + 00(WSW)	9.0	M	11.0	3.8	3.8
4 + 00(SSW)					0
5 + 00 (NNE)	6.0	M	5.0	1.9	6.3
	4.0	D	6.0	1.2	
	2.0	M	6.0	0.3	
	10.0	S	11.00	2.9	
6 + 00 (NE)	13.0	M	12.0	7.2	11.5
	11.0	S	9.0	3.3	
	4.0	M	8.0	1.0	
7 + 00(ENE)	14.0	S	12.0	4.4	4.4
8 + 00 (SW)	5.0	M	5.0	1.4	5.2
	9.0	M	11.0	3.8	
9 + 00(NNW)	13.0	M	12.0	7.2	7.2
10 + 88 (W)	7.0	D	4.0	0.3	2.3
	4.0	M	7.0	1.0	
	4.0	M	4.0	1.0	

4.8 Average

48.1 Total

TABLE 5  
MOUNTAIN STONY LOAM (OAK)  
YIELD OF GAMBEL OAK

Station	Foliage		Area (ft. <sup>2</sup> )	Average Diameter (in.)	Average Area	Number of Stems	Basal Area (in. <sup>2</sup> )	Pounds Air-Dry	Height (ft.)
	W. ft.	L. ft.							
1+00 (SSW)	1	2	2	.3	.07	1	.07	.02	4
	2	5	10	2.5	4.91	1	4.91	.44	7
	1	4	4	.2	.03	5	.15	--	3
TOTAL								.46	
2+00 (WSW)	3	4	12	3.5	9.62	1	9.62	.60	22
	2	4	8	3.7	10.75	1	10.75	.51	23
	3	3	9	3.0	7.07	1	7.07	.46	12
	3	5	15	0.4	.125	10	1.25	.31	3
	1	1	1	0.7	.385	1	.385	.07	5
	2	2	4	2.2	3.8	1	3.8	.24	10
TOTAL								2.19	
3+00 (SW)	1	2	2	0.3	.07	5	.35	.08	3.5
	2	3	6	0.3	.07	7	.49	.15	1.5
	1	2	2	3.5	9.62	1	9.62	.24	20
	4	7	28	3.5	9.62	3	19.24	1.18	22
	2	3	6	0.1	.008	15	.12	.05	1
	1	1	1	2.5	4.91	1	4.91	.14	8
	4	5	20	4.0	12.57	1	12.57	.88	26
	2	3	6	0.2	.03	12	.36	.13	2
	3	3	9	4.0	12.57	1	12.57	.56	24
	3	3	9	3.7	10.75	1	10.75	.55	14
	1	5	5	0.3	.07	8	.56	.14	3.5
TOTAL								4.10	
4+00 (SW)	4	5	20	5.0	19.63	1	19.63	1.02	15
	4	5	20	5.5	25.55	1	25.55	1.30	13
	3	5	15	4.3	14.52	1	14.52	.78	9
	3	7	21	0.2	.03	17	.51	.29	1
	2	3	6	1.5	1.77	1	1.77	.23	6
	2	8	16	0.3	.07	13	.91	.31	2
	1	3	3	1.3	1.33	1	1.33	.13	5
	2	5	10	1.8	2.54	2	5.08	.44	6
TOTAL								4.50	
5+00 (SW)	2	2	4	2.6	5.31	1	5.31	.27	10
	3	3	9	0.5	.196	1	.196	.28	3
	2	2	4	0.7	.385	4	1.54	.15	4
	2	4	6	3.2	8.04	1	8.04	.39	14
	2	2	4	0.3	.07	7	.49	.12	3
	1	4	4	1.3	1.33	1	1.33	.16	5
	1	3	3	0.5	.07	4	.28	.05	3
	1	3	3	1.5	1.77	1	1.77	.16	7
	1	6	6	0.1	.008	16	.128	.04	1
	3	3	9	3.7	10.75	1	10.75	.55	12
	2	3	6	2.8	6.16	1	6.16	.36	10
	1	2	2	0.7	.385	3	1.15	.10	6
	3	4	12	3.8	11.34	1	11.34	.63	12
	2	4	8	3.0	7.07	1	7.07	.43	12
	3	3	9	3.0	7.07	1	7.07	.46	12
	2	3	5	2.5	4.91	1	4.91	.31	10
	2	2	4	2.0	3.14	1	3.14	.21	9
	1	3	3	0.8	.503	6	3.02	.18	5
2	3	6	1.0	.785	6	4.71	.34	6	
1	1	1	1.3	1.33	1	1.33	.08	9	
TOTAL								5.27	

TABLE 5 (CONT'D.)  
MOUNTAIN STONY LOAM (OAK)  
YIELD OF GAMBEL OAK

Station	Foliage		Area (ft. <sup>2</sup> )	Average Diameter (in.)	Average Area	Number of Stems	Basal Area (in. <sup>2</sup> )	Pounds Air-Dry	Height (ft.)
	W. ft.	L. ft.							
6+00 (SW)	1	2	2	1.5	1.77	1	1.77	.13	10
	1	3	3	0.9	.636	4	2.54	.17	7
	1	3	3	0.3	.07	6	.42	.10	2
	1	3	3	0.3	.07	5	.35	.07	3
	1	2	2	1.2	1.13	1	1.13	.10	8
	2	3	6	1.0	.785	3	2.35	.24	8
	1	2	2	0.2	.03	8	.24	.05	1
	3	3	9	3.5	9.62	1	9.62	.53	11
	3	3	9	3.8	11.34	1	11.34	.55	12
	3	3	9	3.4	9.07	1	9.07	.53	9
	1	2	2	1.0	.785	1	.785	.10	6
	3	15	15	1.5	1.77	5	8.85	.65	9
	1	2	2	0.2	.03	7	.21	.03	1
	1	1	2	0.7	.385	1	.385	.07	5
TOTAL								3.32	
7+00 (WSW)	1	4	4	0.3	.07	8	.56	.12	3
	2	4	8	0.8	.503	5	2.65	.30	6
	1	2	2	0.7	.385	1	.385	.07	5
	1	2	2	0.2	.03	5	.15	.02	1
	2	5	10	1.5	1.77	4	7.08	.49	8
	1	2	2	0.2	.03	7	.21	.05	3.5
	1	4	4	1.5	1.77	2	3.54	.24	8
	2	3	6	2.7	5.71	1	5.71	.36	9
	3	5	15	0.2	.03	18	.54	.24	2
	1	2	2	2.6	4.91	1	4.91	.18	8
	2	4	8	0.3	.07	8	.56	.18	3.5
	1	1	1	1.2	1.13	1	1.13	.08	6
	2	3	6	0.4	.12	9	1.08	.19	3.5
	3	4	12	2.3	4.2	4	16.8	.73	9
	2	4	8	0.6	.283	7	1.98	.26	4
	2	2	4	1.5	1.77	1	1.77	.18	7
	2	4	8	0.7	.385	9	3.46	.30	4
	3	3	9	0.2	.03	13	0.39	.19	2
	2	3	6	1.6	1.9	1	1.90	.23	4
TOTAL								4.41	
8+00 (WSW)	2	3	6	0.2	.03	6	.18	.05	2
	1	3	3	2.3	4.2	1	4.2	.20	8
	2	5	10	0.3	.07	12	.84	.25	2
	2	2	4	0.9	.64	1	.64	.16	6
	1	3	3	0.2	.03	5	.15	.02	2
	1	2	2	0.2	.03	6	.18	.01	2.5
	1	1	1	0.8	.50	1	.50	.07	4
TOTAL								0.76	
9+00 (SW)	1	1	1	0.3	.07	3	.21	.03	2.5
	1	4	4	0.7	.385	6	2.31	.18	3
	2	3	6	1.3	1.33	4	5.32	.34	6
	1	4	4	0.6	.28	5	1.4	.17	4
	2	3	6	0.7	.385	7	2.69	.26	3
	2	4	8	3.8	11.34	1	11.34	.51	12
	2	5	10	0.3	.07	14	.98	.25	2
	1	7	7	0.2	.03	12	.36	.16	3
TOTAL								1.90	

TABLE 5 (CONT'D.)  
MOUNTAIN STONY LOAM (OAK)  
YIELD OF GAMBEL OAK

Station	Foliage		Area (ft. <sup>2</sup> )	Average Diameter (in.)	Average Area	Number of Stems	Basal Area (in. <sup>2</sup> )	Pounds Air-Dry	Height (ft.)	
	W. ft.	L. ft.								
10+00	2	4	8	0.5	.196	10	1.96	.26	3.5	
	1	1	1	1.2	1.13	1	1.13	.08	7	
	1	4	4	0.6	.28	4	1.12	.16	3	
	1	3	3	2.1	3.49	1	3.49	.20	8	
	2	3	6	2.7	5.71	1	5.71	.36	9	
	1	6	6	0.2	.03	10	.3	.15	2	
	2	2	4	1.8	2.54	1	2.54	.21	6	
	3	4	12	0.8	.5	7	3.5	.42	4	
	2	7	14	0.3	.07	23	1.61	.35	2	
	3	6	18	1.8	2.54	9	22.86	1.20	9	
	2	6	12	3.1	7.57	4	30.28	1.07	14	
	3	8	24	3.5	9.62	4	38.00	2.20	17	
	1	2	2	0.3	.07	6	.42	.09	2	
	TOTAL							6.75		

TABLE 6

YIELD OF ROCKY MOUNTAIN JUNIPER  
MOUNTAIN STONY LOAM (OAK)

Station	Crown Diameter	Denseness	Pounds	
1 + 100	5.5	S	1.4	
SSW	4.0	D	<u>1.2</u>	2.6
3 + 00				
SW	8.0	S	2.3	2.3
4 + 00	11.0	S	3.3	
SW	7.0	S	<u>1.9</u>	5.2
6 + 00	3.0	M	0.6	
SW	5.0	S	<u>1.3</u>	1.9
7 + 00				
WSW				
8 + 00	7.0	S	JUOS	1.9
	8.0	M		3.8
9 + 00	3.0	S	JUOS	0.6
SW	6.0	M	PIED	1.9
	5.0	S	PIED	<u>1.3</u>
				3.2

TABLE 7

## VEGETATIVE COVER - MOUNTAIN STONY LOAM (OAK) Sq. Ft./Plot

Species	1	2	3	4	5	6	7	8	9	10	TOTAL 20 PLOTS	AVERAGE PER PLOT	PERCENT OF TOTAL VEGETATION	PERCENT OF TOTAL COVER
CAREX	--	--	.2	--	--	--	0.2	0.7	--	--	1.6	.08	1	1
POPR	--	--	T	--	0.2	--	--	--	0.3	T	4.5	.22	4	2
POFE	--	--	--	--	--	0.5	--	0.2	--	--	0.7	.04	1	T
AGTR	--	--	--	--	--	--	--	--	--	--	0.1	.01	T	T
AGSU	--	--	--	--	--	--	--	--	--	--	0.1	.01	T	T
TOTAL GRASSES												.36	6	3
ARLU	--	--	--	--	--	T	0.1	--	--	T	0.4	.02	T	T
SMST	0.2	--	--	--	--	--	--	--	--	--	0.3	.02	T	T
ASTER	--	--	.1	0.1	--	--	--	--	--	--	0.2	.01	T	T
SOLID	--	--	--	0.2	0.3	--	--	--	0.1	0.2	1.2	.06	1	1
LUPIN	--	--	--	--	0.2	--	--	--	--	--	0.2	.01	T	T
TOTAL FORBS												.12	1	1
JVSU	--	--	--	--	--	--	--	--	--	--	0.5	.02	T	T
CHNA2	--	--	--	--	--	--	--	--	--	--	0.3	.02	T	T
CELE3	--	--	--	--	--	1.3	--	--	--	--	3.8	.19	3	2

TABLE 7 (Cont'd.)

## VEGETATIVE COVER - MOUNTAIN STONY LOAM (OAK) Sq. Ft./Plot

Species	11	12	13	14	15	16	17	18	19	20
POPR	1.5	--	--	--	--	0.8	0.5	--	1.2	--
CAREX	--	0.1	--	0.3	--	--	--	--	--	0.1
AGTR	--	--	--	--	0.1	--	--	--	--	--
AGSU	--	--	--	--	0.1	--	--	--	--	--
SOLID	--	--	--	--	--	0.1	--	--	--	0.3
LUPIN	0.1	0.3	--	--	--	--	--	--	--	--
ARLU	--	--	--	0.2	--	--	--	--	--	0.1
SMST	--	--	--	--	0.1	--	--	--	--	--
QUGA	4.5	2.7	--	--	3.7	3.2	2.7	3.0	4.2	3.7
JUSC	--	0.5	--	--	--	--	--	--	--	--
ACGR3	--	1.5	7.0	5.5	--	--	--	--	--	--
PAMY	--	--	0.2	--	0.2	--	--	--	--	--
SYOR2	--	--	--	--	1.2	--	3.0	2.5	--	--
CHNA2	--	--	--	--	--	--	0.3	--	--	--
CELE3	--	--	--	--	--	--	2.5	--	--	--
TOTAL VEGETATIVE COVER	6.1	5.1	7.2	6.0	5.4	4.1	9.0	5.5	6.4	4.2

TABLE 7 (Cont'd.)

## VEGETATIVE COVER - MOUNTAIN STONY LOAM (OAK) Sq. Ft./Plot

Species	1	2	3	4	5	6	7	8	9	10	TOTAL 20 PLOTS	AVERAGE PER PLOT	PERCENT OF TOTAL VEGETATION	PERCENT OF TOTAL COVER
JUSC	--	--	--	--	1.8	--	--	--	--	--	2.3	.12	2	1
BERE	--	--	--	--	0.5	--	--	--	--	--	0.5	.02	T	T
SYOR2	--	--	.1	--	0.5	1.1	1.3	--	1.5	--	11.2	.56	11	6
ACGR3	--	5.5	--	--	--	--	1.0	--	--	--	20.5	1.02	19	11
QUGA	2.2	2.5	5.2	5.2	1.2	2.3	0.9	2.0	3.4	4.7	57.3	2.86	52	30
AMAL2	0.6	--	--	--	--	--	--	--	--	--	0.6	.03	1	T
ROWOV	0.7	T	--	--	--	--	--	--	--	--	0.7	.04	1	T
PAMY	1.1	0.1	--	--	--	--	--	--	--	--	1.6	.08	1	T
RIMO2	2.8	ft.2	--	--	--	--	--	--	--	--	2.8	.14	3	1
LITTER	2.0	1.5	3.0	.9	4.9	3.9	1.5	1.0	3.2	4.7	26.6	2.41*	-	26
BARE	--	--	1.0	1.2	--	0.5	1.1	1.7	1.1	--	7.6	.71*	-	7
ROCK	--	--	--	2.0	--	--	3.5	4.0	--	--	9.5	.90*	-	9
TOTAL SHRUBS														
TOTAL VEGE-												5.09	93	54
TATIVE COVER	7.6	8.1	5.6	5.5	4.7	5.2	3.5	2.9	5.3	4.9	112.3	5.58	100	58

\* Adjusted average to total 9.6 sq.ft.

TABLE 8

## MOUNTAIN STONY LOAM (OAK)

## COVER DETERMINATIONS

Computations for 10 Plots

$$s^2 = \frac{\sum(x - \bar{X})^2}{n-1}$$

	x	$\bar{X}$	(x- $\bar{X}$ )	(x- $\bar{X}$ ) <sup>2</sup>
1.	7.6	5.33	2.3	5.29
2.	8.1		2.8	7.84
3.	5.6		0.3	.09
4.	5.5		0.2	.04
5.	4.7		-0.6	.24
6.	5.2		-0.1	.01
7.	3.5		-1.8	3.24
8.	2.9		-2.4	5.76
9.	5.3		0	0
10.	4.9		-0.4	.16
	<u>53.3</u>			<u>22.67</u>

$$s^2 = \frac{22.67}{9} = 2.52$$

$$s = 1.58$$

$$n = \frac{(1.64)^2(1.58)^2}{[5.33(0.1)]^2} = \frac{2.69 \times 2.50}{0.28} = \frac{6.7}{0.28} = 23.9$$

Computations for 20 Plots

1.	7.6	5.62	1.98	3.92
2.	8.1		2.48	6.15
3.	5.6		0	0
4.	5.5		-0.10	0.01
5.	4.7		-0.92	0.84
6.	5.2		-0.42	0.18
7.	3.5		-2.12	4.49
8.	2.9		-2.72	7.40
9.	5.3		-0.32	0.10
10.	4.9		-0.72	0.52
11.	6.1		0.48	0.23
12.	5.1		-0.52	0.27
13.	7.2		1.58	2.50
14.	6.0		0.38	0.14
15.	5.4		-0.22	0.05
16.	4.1		-1.52	2.31
17.	9.0		3.38	11.42
18.	5.5		-0.12	0.01
19.	6.4		0.78	0.61
20.	4.2		-1.42	2.02
				<u>43.17</u>

$$s^2 = \frac{43.17}{19} = 2.27$$

$$s = 1.51$$

$$n = \frac{(1.64)^2(1.51)^2}{[5.62 \times 0.1]^2} = \frac{2.69 \times 2.28}{0.31} = \frac{6.13}{0.31} = 19.8$$

so, 20 plots are adequate.

TABLE 9  
POINT-QUARTER DETERMINATIONS  
MOUNTAIN STONY LOAM (OAK)

		D I S T A N C E / F T.									
QUADRAT		1	2	3	4	5	6	7	8	9	10
	NE	1	5	3	3	3	6	2	6	1	3
	NW	1	3	4	6	1	3	10	10	2	8
	SW	1	1	7	10	8	4	5	8	2	1
	SE	2	1	4	5	6	7	1	8	7	7
MEAN		1.25	2.5	4.5	6.0	4.5	5.0	4.5	8.0	3.0	4.75
		11	12	13	14	15	16	17	18	19	20
	NE	2	3	2	4	5	10	4	3	4	4
	NW	4	3	1	6	3	5	1	3	4	6
	SW	5	6	2	7	4	7	2	4	1	3
	SE	7	9	2	9	6	3	3	6	2	4
MEAN		4.5	5.25	1.75	6.5	4.5	6.25	2.5	4.0	2.75	4.25
		21	22	23	24	25	26	27	28	29	30
	NE	6	2	3	5	5	1	2	2	5	3
	NW	5	4	1	4	3	1	8	1	3	4
	SW	8	4	1	2	8	1	5	1	2	6
	SE	9	5	2	1	16	3	1	2	4	4
MEAN		7.0	3.75	1.75	3.0	8.00	1.5	4.0	1.5	3.5	4.25
		31									
	NE	4									
	NW	3									
	SW	5									
	SE	4									
MEAN		4.0									

MEAN OF 31 PLOTS = 4.15

$$\text{TOTAL DENSITY OF WOODY SPECIES} = \frac{43560}{(4.15)^2} = \frac{43560}{17.22} = 2,530 \text{ INDIVIDUALS PER ACRE}$$

TABLE 10  
MOUNTAIN STONY LOAM (OAK)

		D I S T A N C E / F T .									
SPECIES	QUADRAT	1	2	3	4	5	6	7	8	9	10
RIMO2	NE	0.5	35.0					41.0	00	00	00
	NW	2.0	75.0					00	00	00	00
	SW	3.0	25.0					00	00	00	00
	SE	5.0	47.0					00	00	00	00
AMAL2	NE	4.0	75.0		45.0	45.0	00	00	75	32	47.0
	NW	5.0	80.0		75.0	50.0	00	00	80	77	00
	SW	3.0	27.0		00	50.0	55.0	00	00	00	00
	SE	8.0	33.0		80.0	65.0	00	00	47	00	00
ROWOU	NE	20.0	16.0				00	00	00	00	00
	NW	11.0	77.0				00	00	00	00	00
	SW	2.0	2.0				00	00	00	00	00
	SE	7.0	15.0				00	00	00	00	00
PAMY	NE	3.0	30.0		60.0	25.0	00	00	00	00	00
	NW	1.0	55.0		00	32.0	00	00	00	00	00
	SW	1.0	0.5		45.0	00	00	00	00	00	00
	SE	2.0	1.0		120.0	45.0	00	00	00	00	00
QUGA	NE	4.0	21.0	3.0	3.0	3.0	22.0	2.0	6	7	3
	NW	1.0	3.0	4.0	6.0	10.0	3.0	10.0	13	5	8
	SW	12.0	9.0	7.0	20.0	8.0	4.0	10.0	15	2	4
	SE	5.0	3.0	5.0	5.0	15.0	15.0	15.0	10	8	9
(Arithm. Avg.)	5.5	9.0	4.8	8.5	9.0	11.0	9.25	11.0	5.5	6.0	
ACGR3	NE	5.0	5.0	50.0	75.0	35.0	17.0	30.0	57	73	77
	NW	17.0	15.0	00	55.0	75.0	8.0	00	00	00	00
	SW	4.0	1.0	40.0	20.0	43.0	00	5.0	00	00	00
	SE	9.0	2.0	12.0	35.0	80.0	12.0	8.0	00	22	28
SYOR2	NE			3.0	5.0	3.0	6.0	12.0	27	1	34
	NW			10.0	35.0	1.0	3.0	23.0	10	2	42
	SW			25.0	10.0	20.0	12.0	31.0	32	24	1
	SE			4.0	22.0	17.0	7.0	1.0	9	7	7
VUSC2	NE			15.0	15.0	22.0	18.0	35.0	00	31	62
	NW			00	20.0	11.0	00	32.0	00	00	00
	SW			17.0	70.0	30.0	9.0	00	39	12	37
	SE			27.0	120.0	00	45.0	00	3.7	46	66
PSME	NE	9.0					00				00
	NW	-					00	00	00	00	00
	SW	100.0					00	00	00	00	00
	SE	50.0					00	00	--	00	00
ABCO	NE	--					00	00	00	00	00
	NW	--					00	00	00	00	00
	SW	6.0					00	00	00	00	00
	SE	--					00	00	00	00	00
ARTR	NE			15.0		35.0	72.0	00	00	00	00
	NW			00		70.0	00	23.0	00	00	00
	SW			18.0		9.0	00	00	00	00	00
	SE			5.0		6.0	47.0	00	8	00	46
CELE	NE				60.0	00	7.0	56.0	14	32	63
	NW				90.0	00	36.0	68.0	00	00	73
	SW				15.0	00	15.0	37.0	00	00	00
	SE				17.0	00	00	00	78	33	00
PLED	NE					55.0	00	42.0	17	00	85
	NW					40.0	00	21.0	36	46	00
	SW					43.0	20.0	13.0	28	00	00
	SE					00	00	00	67	52	42

TABLE 11

MOUNTAIN STONY LOAM (OAK)  
POINT-QUARTER TOTAL DENSITY WOODY SPECIES

Computation for 10 Plots

$$s^2 = \frac{\sum(x - \bar{X})^2}{n-1}$$

	X	$\bar{X}$	$(x - \bar{X})$	$(x - \bar{X})^2$
1.	1.25	4.4	-3.15	9.92
2.	2.5		-1.9	3.61
3.	4.5		0.1	.01
4.	6.0		1.6	2.56
5.	4.5		0.1	.01
6.	5.0		0.6	0.36
7.	4.5		0.1	.01
8.	8.0		3.6	12.96
9.	3.0		-1.4	1.96
10.	4.75		0.35	0.12
	<u>44.00</u>			<u>31.52</u>

$$s^2 = \frac{31.5}{9} = 3.5$$

$$s = 1.87$$

$$n = \frac{(1.28)^2 (1.87)^2}{[(4.4 \times 0.1)]^2} = \frac{1.63 \times 3.50}{.19} = 30.0$$

Computation for 30 Plots

1.	1.25	4.15	-2.9	8.41
2.	2.5		-1.65	2.72
3.	4.5		0.35	0.12
4.	6.0		1.85	3.42
5.	4.5		0.35	0.12
6.	5.0		0.85	0.72
7.	4.5		0.35	0.12
8.	8.0		3.85	14.82
9.	3.0		-1.15	1.32
10.	4.75		0.60	0.36
11.	4.5		0.35	0.12
12.	5.25		1.10	1.21
13.	1.75		-2.4	5.76
14.	6.5		2.35	5.52
15.	4.5		0.35	0.12
16.	6.25		2.10	4.41
17.	2.5		-1.65	2.72
18.	4.0		-0.15	0.02
19.	2.75		-1.4	1.96
20.	4.25		0.1	0.01
21.	7.0		2.85	8.12
22.	3.75		-0.40	0.16
23.	1.75		-2.4	5.76
24.	3.0		-1.15	1.32
25.	8.0		3.85	14.82
26.	1.5		-2.65	7.02
27.	4.0		-0.15	0.02
28.	1.5		-2.65	7.02
29.	3.5		-0.65	0.42
30.	4.25		0.10	0.01
	<u>124.50</u>			<u>98.65</u>

$$s^2 = \frac{98.65}{29} = 3.4$$

$$s = 1.84$$

$$n = \frac{(1.28)^2 (1.84)^2}{(4.15 \times .1)^2} = \frac{1.64 \times 3.39}{0.18} = \frac{5.56}{.18} = 30.8 \text{ or } 31$$

So use Plot 31

$$\bar{X} \text{ is still } 4.15 \quad s^2 = \frac{98.67}{30} = 3.29 \quad s = 1.81$$

$$n = \frac{(1.28)^2 (1.81)^2}{(4.15 \times .1)^2} = \frac{1.64 \times 3.29}{0.18} = \frac{5.4}{.18} = 30.0$$

So, 31 Plots are enough.

## TABLE 12

## SPECIES LIST

## MOUNTAIN STONY LOAM (OAK) RANGE SITE

<u>CODE</u>	<u>SCIENTIFIC NAME</u>	<u>COMMON NAME</u>
<u>Grasses</u>		
*AGCR	Agropyron cristatum	crested wheatgrass
AGSM	Agropyron smithii	western wheatgrass
AGSU	Agropyron subsecundum	bearded wheatgrass
AGTR	Agropyron trachycaulum	slender wheatgrass
BRCA5	Bromus carinatus	mountain brome
*BRTE	Bromus tectorum	cheatgrass
CAREX	Carex spp.	sedge
KOCR	Koeleria cristata	prairie junegrass
POFE	Poa fendleriana	muttongrass
*POPR	Poa pratensis	Kentucky bluegrass
PORE	Poa reflexa	nodding bluegrass
STC03	Stipa columbiana	Columbia needlegrass
<u>Forbs</u>		
ACMIL	Achillea millefolium lanulosa	Western yarrow
ANTEN	Antennaria spp.	pussytoes
ARDR4	Artemisia dracunculus	tarragon
ARLU	Artemisia ludoviciana	Louisiana sagewort
ASTER	Aster spp.	aster
CIFO	Cirsium foliosum	elk thistle
ERIGE2	Erigeron spp.	daisy
GIAG	Gilia aggregata	skyrocket gilia
GRSQ	Grindelia squarrosa	curlycup gumweed
LIPEL	Linum perenne lewisii	Lewis flax
LUPIN	Lupinus spp.	lupine
PENST	Penstemon spp.	penstemon
PHST2	Phlox standburyi	stansbury phlox
PODO4	Polygonum douglasii	Douglas knotweed
SMST	Smilacina stellata	starry false-Solomons-seal
SOLID	Solidago spp.	goldenrod
*TRDU	Tragopogon dubius	yellow salsify
VIMU	Viguiera multiflora	showy goldeneye

TABLE 12 (CONT'd.)

## SPECIES LIST

## MOUNTAIN STONY LOAM (OAK) RANGE SITE

<u>CODE</u>	<u>SCIENTIFIC NAME</u>	<u>COMMON NAME</u>
<u>Shrubs and Trees</u>		
ACGR3	<i>Acer grandidentatum</i>	bigtooth maple
AMAL2	<i>Amelanchier alnifolia</i>	saskatoon serviceberry
BERE	<i>Berberis repens</i>	Oregon-grape
CELE3	<i>Cercocarpus ledifolius</i>	curlleaf mountainmahogany
CHNA2	<i>Chrysothamnus nauseosus</i>	rubber rabbitbrush
CHV18	<i>Chrysothamnus viscidiflorus</i>	Douglas rabbitbrush
FAPA	<i>Fallugia paradoxa</i>	apacheplume
HODU	<i>Holodiscus dumosus</i>	bush oceanspray
*JUOS	<i>Juniperus osteosperma</i>	Utah juniper
JUSC2	<i>Juniperus scopulorum</i>	Rocky Mountain juniper
PAMY	<i>Pachystima myrsinites</i>	Myrtle pachystima
PIED	<i>Pinus edulis</i>	pinyon pine
PIPO	<i>Pinus ponderosa</i>	ponderosa pine
PRVI	<i>Prunus virginiana</i>	common chokecherry
PSME	<i>Pseudotsuga menziesii</i>	Douglas-fir
QUGA	<i>Quercus gambelii</i>	gambel oak
RIM02	<i>Ribes montigenum</i>	gooseberry currant
ROWOU	<i>Rosa Woodsii ultramontana</i>	woods rose
SACA10	<i>Sambucus caerulea</i>	blue elderberry
SYOR2	<i>Symphoricarpus oreophilus</i>	mountain snowberry

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\*NOT NATIVE TO THE SITE

TABLE 13  
 UPLAND STONY LOAM (PINYON-JUNIPER)  
 Dry Weight-Pinyon Pine

Station	Crown Spread	Denseness	Height	Pounds	Total/100'
1 + 00(SW)	1.0	S	2.0	0.01	0.01
2 + 00 (WSW)	1.0 11.0 1.5	S M M	1.0 14.0 2.0	0.01 4.00 0.04	4.5
3 + 00(WSW)	3.0	S	4.0	0.1	0.1
4 + 00					0
5 + 00(NNE)	2.0	S	4.0	0.05	0.5
6 + 00 (NE)	5.0 5.0	M S	8.0 8.0	0.6 0.5	1.1
7 + 00 (ENE)	16.0 7.0 3.0 2.0 5.0	S S S M S	21.0 11.0 5.0 4.0 9.0	8.0 1.1 0.1 0.06 0.5	9.8
8 + 00(SW)	7.0	M	10.0	1.4	1.4
9 + 00 (WNW)	2.0 7.0	S S	5.0 11.0	0.05 1.1	1.15
10 + 00 (W)	1.0 6.0 5.0 10.0	M S M M	2.0 8.0 6.0 11.0	0.01 0.8 0.6 3.2	4.61
					5.0

TABLE 14

UPLAND STONY LOAM (P-J)  
 DRY WEIGHT GAMBEL OAK

Station	Foliage		Area (ft. <sup>2</sup> )	Average Diameter (in.)	Average Area	Number of Stems	Basal Area (in. <sup>2</sup> )	Pounds Air-Dry	Height (ft.)	
	W. ft.	L. ft.								
3+00 (WSW)	2	4	8	0.4	.126	8	1.0	.26	4.0	
	1	2	2	1.4	1.54	1	1.54	.08	5.0	
	2	4	8	1.2	1.13	7	7.92	.47	5.0	
	2	4	8	0.8	.50	4	2.01	.32	6.0	
	1	3	3	1.1	.95	2	1.9	.08	4.0	
	2	4	8	0.5	.2	8	1.6	.31	3.0	
	TOTAL								1.52	
4+00 (ENE)	3	4	12	0.7	.38	9	3.46	.49	4.0	
	2	5	10	1.0	.78	8	6.3	.50	5.0	
	1	4	4	0.2	.03	7	.22	.08	2.0	
	2	4	8	1.2	1.13	5	5.65	.43	6.0	
	1	3	3	0.7	.38	3	1.14	.13	5.0	
	2	2	4	2.0	3.14	1	3.14	.22	6.0	
	2	6	12	0.8	.50	8	4.00	.51	5.0	
	2	5	10	0.2	.03	16	.48	.31	1.0	
	2	5	10	1.4	1.53	6	9.2	.55	6.0	
	3	4	12	1.4	1.53	4	6.16	.56	6.0	
	TOTAL								3.78	
	5+00 (NNE)	1	3	3	0.4	.13	5	.62	.13	3.0
3		2	6	0.3	.07	4	.28	.10	10.0	
TOTAL								.23		
6+00								0		
7+00 (ENE)	2	4	8	0.2	.03	12	.38	.18	2.0	
	1	4	4	2.5	4.91	1	4.91	.26	6.0	
	2	6	12	0.3	.07	20	1.4	.41	3.0	
	1	2	2	0.3	.07	3	.21	.05	4.0	
	1	4	4	1.7	1.33	1	1.33	.18	5.0	
	2	2	4	1.5	1.77	1	1.77	.19	8.0	
	1	4	4	0.5	.20	3	.60	.16	3.0	
	2	3	6	1.8	2.54	1	2.54	.28	5.0	
	2	2	4	0.6	.28	2	.56	.16	3.0	
	2	5	10	0.8	.50	4	2.0	.38	4.0	
	TOTAL								2.25	
	8+00 (SW)	2	4	8	1.2	1.13	2	2.26	.32	6.0
1		4	4	0.3	.07	4	.28	.08	2.0	
1		4	4	1.0	.79	6	4.74	.26	3.0	
2		5	10	0.5	.97	5	.98	.35	4.0	
TOTAL								1.01		
9+00 (WNW)								0		

TABLE 15

## VEGETATIVE COVER - UPLAND STONY LOAM (P-J) Sq. Ft./Plot

Species	1	2	3	4	5	6	7	8	9	10	11	12	13
ELSA	0.1	1.5	0.9	T	0.2	-	0.2	-	.2	0.3	--	--	--
ORHY	0.4	-	-	-	-	.5	-	0.6	.1	-	0.4	0.6	0.2
BOGR2	-	-	-	2.2	0.1	-	0.8	-	-	-	-	-	-
CAREX	-	-	-	-	0.5	-	-	-	-	-	-	-	-
ARLU	-	T	-	-	-	.2	-	0.3	-	-	-	-	-
CHVI6	-	T	-	0.2	0.5	-	-	-	-	-	-	-	-
ARABI2	-	-	-	-	-	-	-	-	.1	-	-	-	-
CHVI8	-	-	-	-	-	-	-	-	-	-	0.5	-	-
CHNA2	-	-	-	-	-	-	-	-	0.1	-	-	-	-
CELE3	-	-	-	-	-	-	-	2.0	-	-	-	-	-
JUOS	-	-	-	-	-	-	-	-	-	1.5	-	-	3.0
EPVI	-	-	-	-	-	-	-	-	-	-	-	-	-
SYOR2	-	-	-	-	-	-	-	-	-	-	0.7	0.2	-
PIED	-	-	-	-	1.2	-	-	-	-	0.5	-	-	-
YUANZ	0.4	-	-	-	T	-	-	-	-	-	-	-	-
ARTR2	-	-	1.1	-	-	-	1.0	-	1.0	0.2	-	-	-
ARARN	-	-	-	.8	-	-	-	-	-	-	-	-	-
QUGA	-	-	-	-	-	.5	-	-	-	-	-	-	-
TOTAL VEGETATIVE COVER	0.9	1.5	2.0	3.2	2.5	1.2	2.0	2.9	1.5	2.5	1.6	0.8	3.2
BARE	5.0	4.6	4.1	3.2	5.3	3.6	4.2	1.0	2.2	0	3.2	5.3	0.5
LITTER	.5	.8	2.0	.5	0.3	2.5	0.7	3.2	2.2	3.9	2.5	0.3	3.9
ROCK	3.6	2.7	1.5	2.7	1.5	2.3	2.7	1.5	3.7	3.2	2.3	3.4	1.5

TABLE 15 (Cont'd.)

## VEGETATIVE COVER - UPLAND STONY LOAM (P-J) Sq. Ft./Plot

Species	14	15	16	17	18	19	20	21	22	23
ELSA	0.2	--	0.6	0.2	0.3	--	0.2	0.2	--	0.6
ORHY	--	0.5	--	0.4	0.2	--	0.1	--	1.3	--
BOGR2	--	--	--	--	--	0.8	0.5	0.3	--	0.8
ARLU	0.3	0.2	--	--	0.4	0.1	--	--	--	--
CHVI8	--	--	--	--	--	--	--	0.1	--	--
OPPO	--	--	0.5	0.3	--	--	--	1.0	--	0.7
ARTR2	--	--	0.8	--	0.5	--	--	--	--	0.2
SYOR2	1.2	--	--	--	--	--	--	--	--	--
PIED	1.0	--	--	--	--	1.0	--	--	--	--
JUOS	--	--	0.3	0.5	--	--	--	0.5	--	0.3
TOTAL VEGETATIVE COVER	2.7	0.7	2.2	1.4	1.4	1.9	0.8	2.1	1.3	2.6

TABLE 15 (Cont'd.)

## VEGETATIVE COVER - UPLAND STONY LOAM (P-J) Sq. Ft./Plot

Species	24	25	26	27	28	29	30
ORHY	0.3	--	--	--	--	--	--
ELSA	0.1	--	0.3	0.5	--	--	0.3
STC04	--	0.5	0.8	--	--	--	--
BOGR2	--	--	--	--	1.2	0.5	--
CAREX	--	--	--	--	--	--	--
ARABI2	--	--	--	--	--	--	--
CHVI6	--	--	--	--	--	--	--
ARLU	0.2	--	--	--	--	--	--
ARARN	--	--	--	--	--	--	--
YUAN2	--	--	--	--	--	--	--
SYOR2	--	--	--	--	--	--	--
CELE3	--	--	--	--	--	--	--
ARTR2	--	--	--	--	--	--	0.1
OPPO	--	--	--	--	0.1	0.6	--
CHVI8	--	--	0.1	0.3	--	--	0.1
EPVI	1.2	--	--	--	--	0.6	--
QUGA	0.8	--	--	--	--	--	--
PIED	--	--	--	--	0.6	--	--
JUOS	--	--	--	--	--	--	0.5
CHNA2	--	--	--	--	--	--	--
TOTAL VEGETATIVE COVER	1.4	1.7	1.2	0.8	1.9	1.7	1.0

TABLE 15 (Cont'd.)

## VEGETATIVE COVER - UPLAND STONY LOAM (P-J) Sq. Ft./Plot

Species	31	32	33	34	35	36	37	38	39	40	TOTAL 40 PLOTS	AVERAGE PER PLOT	* PERCENT OF TOTAL VEGETATION	PERCENT OF TOTAL COVER
ELSA	0.9	--	0.3	0.3	--	0.5	0.2	0.2	0.4	--	9.9	.25	13	3
ORHY	T	0.1	--	--	0.6	--	--	0.2	--	--	6.8	.17	9	2
BOGR2	--	--	--	--	--	0.6	--	--	0.1	0.5	8.4	.21	12	2
STC04	--	--	--	--	--	--	--	--	--	--	1.3	.03	2	T
TOTAL GRASSES												.66	36	7
ARABI2	--	--	--	--	--	--	--	--	--	--	0.1	T	T	T
ARLU	T	--	--	0.3	--	--	--	--	T	--	2.0	.05	3	1
CHVI6	--	0.2	--	--	--	--	--	T	--	--	0.9	.02	1	T
ASDI5	--	--	--	T	--	--	--	--	--	--	T	T		
TOTAL FORBS												.07	4	1
QUGA	--	--	--	--	--	--	--	--	--	--	1.8	.04	2	T
ARARN	--	--	--	--	--	--	--	--	--	--	0.8	.02	1	T
CELE3	--	--	--	--	--	--	--	--	--	--	2.0	.05	3	1
OPPO	--	--	--	--	--	--	--	--	--	0.3	3.5	.09	5	1
EPVI	--	--	--	--	--	--	0.3	--	--	--	2.1	.05	3	1
SYOR2	--	--	--	--	--	0.2	--	--	--	--	2.3	.06	3	1
PIED	--	--	--	2.1	--	--	1.0	--	--	--	6.4	.16	9	2
YUAN2	--	--	0.2	--	--	--	0.2	--	--	--	0.8	.02	1	T
CHVI8	--	--	0.1	--	0.5	--	--	--	T	0.2	1.9	.05	3	1
JUOS	.5	--	--	--	--	0.9	3.0	0.8	--	--	13.2	.33	18	3
ARTR2	0.4	1.4	T	--	--	0.3	0.1	--	T	1.0	8.4	.21	12	2
CHNA2	--	--	--	--	--	--	--	--	--	--	0.1	T	T	T
TOTAL SHRUBS												1.08	60	12
TOTAL VEGETATION	1.8	1.7	0.6	2.7	1.1	2.2	1.5	1.4	0.5	1.3		1.81	100	20
BARE	2.6	3.7	3.8	1.5	2.4	2.3	1.3	3.0	4.4	4.3		3.2	-	32
LITTER	4.0	--	.7	3.7	1.3	1.5	1.6	2.5	1.2	1.5		1.8	-	19
ROCK	1.2	4.2	4.5	1.7	4.8	2.3	2.1	2.7	3.5	1.8		2.8	-	29

\*The percent of total vegetation column shows species diversity by vegetation cover when compared with all other species.

TABLE 16  
 UPLAND STONY LOAM (PINYON-JUNIPER)  
 VEGETATIVE COVER DETERMINATIONS

Computation for 10 Plots

$$s^2 = \frac{\sum (x - \bar{x})^2}{n-1}$$

	x	$\bar{x}$	(x- $\bar{x}$ )	(x- $\bar{x}$ ) <sup>2</sup>
1.	0.9	2.02	-1.12	1.25
2.	1.5		-0.52	0.27
3.	2.0		0	0
4.	3.2		1.18	1.39
5.	2.5		0.48	.23
6.	1.2		-0.82	.67
7.	2.0		0	0
8.	2.9		.88	0.77
9.	1.5		-0.52	0.27
10.	<u>2.5</u>		<u>0.48</u>	<u>.23</u>
	20.2			5.08

$$s^2 = \frac{5.08}{9} = 0.56$$

$$n = \frac{(1.64)^2 (0.74)^2}{[(2.02) (0.1)]^2} = \frac{2.69 \times 0.55}{.04} = \frac{1.48}{.04} = 36.9 \text{ or } 37$$

	x	$\bar{x}$	(x- $\bar{x}$ )	(x- $\bar{x}$ ) <sup>2</sup>
26.	1.2	1.7	-0.5	0.25
27.	0.8		-0.9	0.81
28.	1.9		0.2	0.04
29.	1.7		0	0
30.	1.0		-0.7	0.49
31.	1.8		0.1	0.01
32.	1.7		0	0
33.	0.6		-1.1	1.21
34.	2.7		1.00	1.00
35.	1.1		-0.6	0.36
36.	2.2		0.5	0.25
37.	<u>1.5</u>		<u>-0.2</u>	<u>0.04</u>
	64.2			18.15

$$s^2 = \frac{18.15}{36} = 0.50 \quad s = 0.71$$

$$n = \frac{(1.64)^2 (0.71)^2}{(1.7 \times .1)^2} = \frac{2.69 \times .50}{.03} = 44.8 \text{ or } 45$$

So, maximum of 40

Computation for 37 Plots

1.	.9	1.7	-0.80	0.64
2.	1.5		-0.20	0.04
3.	2.0		0.30	0.09
4.	3.2		1.5	2.25
5.	2.5		0.8	0.64
6.	1.2		-0.5	0.25
7.	2.0		0.3	0.09
8.	2.9		1.2	1.44
9.	1.5		-0.2	0.04
10.	2.5		0.8	0.64
11.	1.6		-0.1	0.01
12.	0.8		-0.9	0.81
13.	3.2		1.5	2.25
14.	2.7		1.00	1.00
15.	0.7		-1.00	1.00
16.	2.2		0.5	0.25
17.	1.4		-0.3	0.09
18.	1.4		-0.3	0.09
19.	1.9		0.2	0.04
20.	0.8		-0.9	0.81
21.	2.1		0.4	0.16
22.	1.3		-0.4	0.16
23.	2.6		0.9	0.81
24.	1.4		-0.3	0.09
25.	1.7		0	0

Computation for 40 Plots

1.	.9	1.7	-0.80	0.64
2.	1.5		-0.20	0.04
3.	2.0		.3	0.09
4.	3.2		1.5	2.25
5.	2.5		0.8	0.64
6.	1.2		-0.5	0.25
7.	2.0		0.3	0.09
8.	2.9		1.2	1.44
9.	1.5		-0.2	0.04
10.	2.5		0.8	0.64
11.	1.6		-0.1	0.01
12.	0.8		-0.9	0.81
13.	3.2		1.5	2.25
14.	2.7		1.00	1.00
15.	0.7		-1.00	1.00
16.	2.2		0.5	0.25
17.	1.4		-0.3	0.09
18.	1.4		-0.3	0.09
19.	1.9		0.2	0.04
20.	0.8		-0.9	0.81
21.	2.1		0.4	0.16
22.	1.3		-0.4	0.16

(Cont'd. in Upper Right Column)

TABLE 16 (Cont'd.)

Computation for 40 Plots

	X	$\bar{X}$	(X- $\bar{X}$ )	(X- $\bar{X}$ ) <sup>2</sup>
23.	2.6	1.7	0.9	0.81
24.	1.4		-0.3	0.09
25.	1.7		0	0
26.	1.2		-0.5	0.25
27.	0.8		-0.9	0.81
28.	1.9		0.2	0.04
29.	1.7		0	0
30.	1.0		-0.7	0.49
31.	1.8		0.1	0.01
32.	1.7		0	0
33.	0.6		-1.1	1.21
34.	2.7		1.0	1.0
35.	1.1		-0.6	0.36
36.	2.2		0.5	0.25
37.	1.5		-0.2	0.04
38.	1.4		-0.3	0.09
39.	0.5		-1.2	1.44
40.	<u>1.3</u>		-0.4	<u>0.16</u>
	67.4			19.84

$$s^2 = \frac{19.84}{39} = 0.51$$

$$n = \frac{(1.64)^2 (0.71)^2}{(1.7 \times .1)^2} = \frac{2.69 \times .51}{.03} = 45.73 \text{ or } 46$$

But maximum of 40 was used.

TABLE 17  
 POINT QUARTER DETERMINATIONS FOR WOODY PLANTS  
 UPLAND STONY LOAM (P-J)

QUADRATS	1	2	3	4	5	6	7	8	9	10	11	12	13	14
NE	6	1	5	7	11	3	8	9	12	7	1	1	1	5
NW	1	14	8	6	15	6	3	6	17	8	3	4	5	7
SW	16	6	19	14	16	10	9	23	21	6	4	3	9	8
SE	1	7	16	9	10	8	17	4	7	19	4	6	5	7
AVE	6	7	12	9	13	7	9	10	14	10	3	4	5	7

MEAN OF 14 PLOTS = 8.28

QUADRATS	15	16	17	18	19	20	21	22	23	24	25	26	27
NE	9	6	8	12	11	12	7	11	8	14	17	13	3
NW	10	7	7	11	3	5	10	12	3	12	3	2	13
SW	8	10	7	6	5	7	4	5	10	9	6	7	4
SE	6	10	5	9	7	7	12	6	12	4	2	13	7
AVE	8	8	7	10	6	8	8	8	8	10	7	9	7

MEAN OF 27 PLOTS = 7.8

TOTAL DENSITY OF ALL WOODY SPECIES =  $\frac{43560}{(7.8)^2}$  =  $\frac{43560}{60.84}$  = 716 INDIVIDUALS PER ACRE

TABLE 18

POINT QUARTER - TOTAL DENSITY WOODY SPECIES

UPLAND STONY LOAM (P-J)

	X	$\bar{X}$	(X- $\bar{X}$ )	(X- $\bar{X}$ ) <sup>2</sup>
1.	6	8.28	-2.28	5.20
2.	7		-1.28	1.64
3.	12		3.72	13.84
4.	9		.72	.52
5.	13		4.72	22.28
6.	7		-1.28	1.64
7.	9		.72	.52
8.	10		1.72	2.96
9.	14		5.72	32.72
10.	10		1.72	2.96
11.	3		-5.28	27.88
12.	4		-4.28	18.32
13.	5		-3.28	10.76
14.	7		-1.28	1.64
	<u>116</u>			<u>142.88</u>

	X	$\bar{X}$	(X- $\bar{X}$ )	(X- $\bar{X}$ ) <sup>2</sup>
15.	8	7.8	0.2	0.04
16.	8		0.2	0.04
17.	7		-0.8	0.64
18.	10		2.2	4.84
19.	6		-1.8	3.24
20.	8		0.2	0.04
21.	8		0.2	0.04
22.	8		0.2	0.04
23.	8		0.2	0.04
24.	10		2.2	4.84
25.	7		-0.8	0.64
26.	9		1.2	1.44
27.	7		-0.8	0.64
	<u>211</u>			<u>161.24</u>

$$S^2 = \frac{142.88}{13} = 10.99$$

$$S = 3.31$$

$$\frac{(1.28)^2 (3.31)^2}{[(8.28) \cdot .1]^2} = \frac{1.638 \times 10.96}{0.68} = \frac{17.95}{0.68} = 26.4 \text{ or } 27 \text{ Plots}$$

$$S^2 = \frac{161.24}{26} = 6.20 \quad S = 2.49$$

$$\frac{(1.28)^2 (2.49)^2}{(7.8 \times .1)^2} = \frac{1.638 \times 6.2}{.61} = \frac{10.15}{.61} = 16.6 \text{ or } 17$$

So, 27 are more than adequate.

Computations for 27 Plots

	X	$\bar{X}$	(X- $\bar{X}$ )	(X- $\bar{X}$ ) <sup>2</sup>
1.	6	7.8	-1.8	3.24
2.	7		-0.8	0.64
3.	12		4.2	17.64
4.	9		1.2	1.44
5.	13		5.2	27.04
6.	7		-0.8	0.64
8.	10		2.2	4.84
9.	14		6.2	38.44
10.	10		2.2	4.84
11.	3		-4.8	23.04
12.	4		-3.8	14.44
13.	5		-2.8	7.84
14.	7		-0.8	0.64

TABLE 19

## SPECIES LIST

## UPLAND STONY LOAM (PINYON-JUNIPER) RANGE SITE

<u>CODE</u>	<u>SCIENTIFIC NAME</u>	<u>COMMON NAME</u>
<u>Grasses</u>		
AGIN	Agropyron inerme	Beardless bluebunch wheatgrass
BOGR2	Bouteloua gracilis	Blue grama
BRTE	Bromus tectorum	Cheatgrass
CAREX	Carex spp	Sedge
ELSA	Elymus salinus	Salina wildrye
KOCR	Koeleria cristata	Prairie junegrass
ORHY	Oryzopsis hymenoides	Indian ricegrass
POFE	Poa fendleriana	Mutton grass
POPR	Poe pratensis	Kentucky bluegrass
STC04	Stipa comata	Needle andthread
<u>Forbs</u>		
ANTEN	Antennaria spp	Pussytoes
ARABI2	Arabis spp	Rockcress
ARLU	Artemisia ludoviciana	Lousiana sagewort
ASDI5	Astragalus diversifolius	Meadow milkvetch
CHVI6	Chrysopsis villosa	Hairy goldaster
PHACE	Phacelia spp	Phacelia
<u>Shrubs and Trees</u>		
ARARN	Artemisia arbuscula nova	Black sagebrush
ARTR2	Artemisia tridentata	Big sagebrush
CELE3	Cercocarpus ledifolius	Curleaf mountainmahogany
CEMO2	Cercocarpus montanus	Birchleaf mountainmahogany
CHNA2	Chrysothamnus nauseosus	Rubber rabbitbrush
CHVI8	Chrysothamnus viscidiflorus	Douglas rabbitbrush
EPYI	Ephedra viridis	Green mormontea
JUOS	Juniperus osteosperma	Utah juniper
MAMMI	Mammillaria spp	Mammillaria
OPPO	Opuntia polyacantha	Plains pricklypear
PIED	Pinus edulis	Pinyon pine
QUGA	Quercus gambelii	Gambel oak
SYOR2	Symphoricarpos oreophilus	Mountain snowberry
YUAN2	Yucca angustissima	Fineleaf yucca

TABLE 20

## DRY WEIGHT DETERMINATIONS

	<u>Green</u>	<u>Dry</u>	<u>Percent Dry Weight</u>
ELSA	59	35	59
LUPINE	11	6	54
POPR	7	4	57
SYOR2	14	7	50
ARLUD	17	9	53
CHVI6	10	5	50
ARTR2	36	17	47
SOLID	54	26	48
BOGR2	5	4	67
CHVI8	12	6	50
ORHY	30	14	47
CAREX	17	9	53
EPVI	15	7	47
AGTR	10	5	50
KOCR	25	12	48
POFE	18	10	56
POSE	8	8	100
ASTER	20	10	50
ERIGE2	12	6	50
PHST2	5	5	100
SMST	10	7	70
TRDU	7	4	57
AMAL2	31	17	55
BERE	39	19	49
PAMY	14	8	57
RIMO2	14	7	50
ROWOV	14	6	43

TABLE 21

POINT-QUARTER DETERMINATIONS  
(BY SPECIES)  
UPLAND STONY LOAM (P-J)

SPECIES	QUADRATS	DISTANCE/FT.													
		1	2	3	4	5	6	7	8	9	10	11	12	13	14
JUUS	NE	15	11	17	11	19	9	8	9	12	32				
	NW	9	21	8	27	24	6	75	13	23	47				
	SW	34	34	19	---*	33	11	23	24	21	6				
	SE	26	57	31	10	12		43	4		34				
PIED	NE	18	12	36	7	13	24	14	22	43	7				
	NW	27	34	32	6	15	16	3	14	17	43				
	SW	19	6	23	--	16	10	9	31	35	8				
	SE	24	9	55	17	27	19		4	7	24				
ARTR2	NE	6	1	16	9	18	3		13	13	14				
	NW	1	14	22	42	20	6	4	6	33	8				
	SW	16	11	17	14	20	14	21	23	24	11				
	SE	21	7	16	16	10	13	26	4	12	27				
PUTR2	NE	9	00	00											
	NW	45	00	00		24									
	SW	00	00	00											
	SE	00	00												
EPV1	NE	26	14	5	36	44				17	22				
	NW	22	21	12	57	21				24	34				
	SW	26	13	32	--		53		24	32					
	SE	1	00	62	--			28		37	26				
CELE3	NE		36	00		57					34				
	NW		62	00				38							
	SW		00	00		44		37		41					
	SE		00	00											
QUGA	NE			22	28	11	12	21		75	68				
	NW			28	24	48	18	17		47	35				
	SW			32	14	38	72	32	37	54	6				
					9	23	8	17		7	19				

TABLE A  
GUIDE FOR DETERMINING CURRENT YIELD OF UTAH JUNIPER IN UTAH

UPLAND STONY LOAM (JUNIPER) SITE

CURRENT YIELD AIR DRY POUNDS

Crown Diameter Feet	Weight Per Tree	10 Trees	50 Trees	100 Trees	200 Trees	300 Trees	400 Trees	500 Trees
<u>Sparse Foliage</u>								
1	0.1	1	5	10	20	30	40	50
2	0.3	3	15	30	60	90	120	150
3	0.6	6	30	60	120	180	240	300
4	1.0	10	50	100	200	300	400	500
5	1.3	13	65	130	260	390	520	650
6	1.6	16	80	160	320	480	640	800
7	1.9	19	95	190	380	570	760	950
8	2.3	23	115	230	460	690	920	1150
9	2.6	26	130	260	520	780	1040	1300
10	2.9	29	145	290	580	870	1160	1450
11	3.3	33	165	330	660	990	1320	1650
12	3.6	36	180	360	720	1080	1440	1800
13	4.0	40	200	400	800	1200	1600	2000
14	4.4	44	220	440	880	1320	1760	2200
15	4.7	47	235	470	940	1410	1880	2350
16	5.1	51	255	510	1020	1530	2040	2550
17	5.5	55	275	550	1100	1650	2200	
18	5.8	58	290	580	1160	1740	2320	
19	6.2	62	310	620	1240	1860	2480	
20	6.6	66	330	660	1320	1980	2640	
<u>Medium Foliage</u>								
1	0.1	1	5	10	20	30	40	50
2	0.3	3	15	30	60	90	120	150
3	0.6	6	30	60	120	180	240	300
4	1.0	10	50	100	200	300	400	500
5	1.4	14	70	140	280	420	560	700
6	1.9	19	95	190	380	570	760	950
7	2.5	25	125	250	500	750	1000	1250
8	3.1	31	155	310	620	930	1240	1550
9	3.8	38	190	380	760	1140	1520	1900
10	4.6	46	230	460	920	1380	1840	2300
11	5.4	54	270	540	1080	1620	2160	2700
12	6.2	62	310	620	1240	1860	2480	
13	7.2	72	360	720	1440	2160		
14	8.1	81	405	810	1620	2430		
15	9.1	91	455	910	1820	2730		
16	10.2	102	510	1020	2040			
17	11.3	113	565	1130	2260			
18	12.4	124	620	1240	2480			
19	13.6	136	680	1360				
20	14.8	148	740	1480				
<u>Dense Foliage</u>								
1	0.1	1	5	10	20	30	40	50
2	0.3	3	15	30	60	90	120	150
3	0.7	7	35	70	140	210	280	350
4	1.2	12	60	120	240	360	480	600
5	1.9	19	95	190	380	570	760	950
6	2.7	27	135	270	540	810	1080	1350
7	3.6	36	180	360	720	1080	1440	1800
8	4.7	47	235	470	940	1410	1880	2350
9	5.9	59	295	590	1180	1770	2360	
10	7.2	72	360	720	1440	2160		
11	8.6	86	430	860	1720	2580		
12	10.2	102	510	1020	2040			
13	11.9	119	595	1190	2380			
14	13.7	137	685	1370	2740			
15	15.6	156	780	1560				
16	17.7	177	885	1770				
17	19.9	199	995	1990				
18	22.2	222	1110	2220				
19	24.6	246	1230	2460				
20	27.2	272	1360	2720				

TABLE B  
 PINYON PINE YIELDS

ANNUAL YIELD PER TREE POUNDS AIR DRY

Crown Diameter	Semidesert Stony Loam (J-P)			Upland Stony Loam (J-P)		
	S	M	D	S	M	D
1	0.01	0.02	0.04	0.01	0.01	0.02
2	0.06	0.09	0.1	0.05	0.06	0.09
3	0.1	0.2	0.3	0.1	0.2	0.2
4	0.3	0.4	0.6	0.3	0.4	0.5
5	0.4	0.6	0.9	0.5	0.6	0.8
6	0.6	0.9	1.3	0.8	0.9	1.2
7	0.9	1.2	1.8	1.1	1.4	1.7
8	1.1	1.5	2.4	1.5	1.9	2.4
9	1.5	2.0	3.0	2.0	2.5	3.0
10	1.9	2.5	3.8	2.6	3.2	4.0
11	2.2	3.0	4.5	3.4	4.0	5.0
12	2.7	3.6	5.4	4.1	5.0	6.0
13	3.2	4.3	6.4	5.0	6.0	7.0
14	3.7	5.0	7.2	6.0	7.0	8.4
15	4.3	5.7	8.4	7.0	8.2	9.8
16	5.0	6.6	9.8	8.0	9.8	
17	5.6	8.0	11.2	9.4		
18	6.4	8.4	12.6			
19	7.0	9.4	14.0			
20	8.0	10.5	15.4			

S = Sparse foliage      M = Medium foliage      D = Dense foliage

Above based on 55 trees on Semidesert stony loam (J-P) site and 37 trees on Upland stony loam (J-P) site. Not enough data for reliable correlation analyses.

TABLE H  
GAMBEL OAKBRUSH YIELD TABLE

MOUNTAIN STONE LOAN RANGE SITE - PAID CONDITION  
Foueds Air Dry

Folilage Area Sq. Ft.	Gross Area Sq. In.																			
	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00
1	.17	.17	.17	.18	.18	.18	.19	.19	.19	.19	.20	.20	.20	.20	.21	.21	.21	.22	.22	.22
2	.24	.24	.25	.25	.25	.26	.26	.27	.27	.27	.28	.28	.28	.29	.29	.29	.30	.30	.30	.31
3	.31	.32	.32	.33	.33	.34	.34	.35	.35	.35	.36	.36	.36	.37	.37	.37	.38	.38	.38	.39
4	.39	.39	.40	.40	.40	.41	.42	.42	.43	.44	.44	.45	.45	.46	.46	.46	.47	.47	.48	.48
5	.44	.44	.47	.47	.47	.48	.48	.50	.50	.52	.52	.53	.53	.53	.54	.55	.56	.56	.57	.58
6	.53	.54	.54	.55	.56	.56	.58	.58	.59	.60	.60	.61	.62	.62	.63	.64	.65	.65	.66	.67
7	.57	.58	.59	.60	.61	.61	.63	.63	.64	.65	.66	.67	.67	.68	.69	.70	.70	.71	.72	.73
8	.61	.63	.63	.64	.65	.66	.68	.68	.69	.70	.70	.71	.72	.72	.73	.74	.75	.75	.76	.77
9	.64	.67	.68	.69	.70	.70	.72	.73	.74	.75	.76	.77	.77	.78	.79	.80	.81	.81	.82	.83
10	.70	.72	.72	.73	.74	.75	.77	.78	.79	.80	.81	.81	.83	.83	.84	.85	.86	.87	.88	.89
11	.74	.76	.77	.78	.79	.80	.82	.83	.84	.85	.86	.87	.88	.89	.90	.91	.92	.93	.94	.95
12	.77	.79	.80	.81	.82	.83	.85	.86	.87	.88	.89	.90	.91	.92	.93	.94	.95	.96	.97	.98
13	.80	.82	.83	.84	.85	.86	.88	.89	.90	.91	.92	.93	.94	.95	.96	.97	.98	.99	1.00	1.00
14	.83	.85	.86	.87	.88	.89	.91	.92	.93	.94	.95	.96	.97	.98	.99	1.00	1.01	1.02	1.03	1.04
15	.86	.88	.89	.91	.92	.93	.95	.96	.97	.98	.99	1.00	1.01	1.02	1.03	1.04	1.05	1.06	1.07	1.08
16	.89	.91	.92	.94	.95	.96	.98	.99	1.00	1.01	1.02	1.03	1.04	1.05	1.06	1.07	1.08	1.09	1.10	1.11
17	.90	.91	.92	.94	.95	.96	.98	.99	1.00	1.01	1.02	1.03	1.04	1.05	1.06	1.07	1.08	1.09	1.10	1.11
18	.93	.94	.96	.97	.98	.99	1.01	1.02	1.03	1.04	1.05	1.06	1.07	1.08	1.09	1.10	1.11	1.12	1.13	1.14
19	.94	.97	.99	1.00	1.01	1.02	1.04	1.05	1.06	1.07	1.08	1.09	1.10	1.11	1.12	1.13	1.14	1.15	1.16	1.17
20	.95	1.00	1.02	1.04	1.05	1.06	1.08	1.09	1.10	1.11	1.12	1.13	1.14	1.15	1.16	1.17	1.18	1.19	1.20	1.21
21	1.02	1.03	1.05	1.07	1.08	1.09	1.11	1.12	1.13	1.14	1.15	1.16	1.17	1.18	1.19	1.20	1.21	1.22	1.23	1.24
22	1.05	1.06	1.08	1.10	1.11	1.12	1.14	1.15	1.16	1.17	1.18	1.19	1.20	1.21	1.22	1.23	1.24	1.25	1.26	1.27
23	1.07	1.08	1.10	1.12	1.14	1.15	1.17	1.18	1.19	1.20	1.21	1.22	1.23	1.24	1.25	1.26	1.27	1.28	1.29	1.30
24	1.10	1.12	1.14	1.16	1.17	1.18	1.20	1.21	1.22	1.23	1.24	1.25	1.26	1.27	1.28	1.29	1.30	1.31	1.32	1.33
25	1.12	1.14	1.16	1.17	1.18	1.20	1.21	1.22	1.23	1.24	1.25	1.26	1.27	1.28	1.29	1.30	1.31	1.32	1.33	1.34
26	1.13	1.14	1.16	1.17	1.18	1.20	1.21	1.22	1.23	1.24	1.25	1.26	1.27	1.28	1.29	1.30	1.31	1.32	1.33	1.34
27	1.15	1.16	1.18	1.20	1.21	1.22	1.24	1.25	1.26	1.27	1.28	1.29	1.30	1.31	1.32	1.33	1.34	1.35	1.36	1.37
28	1.17	1.18	1.20	1.22	1.24	1.25	1.27	1.28	1.29	1.30	1.31	1.32	1.33	1.34	1.35	1.36	1.37	1.38	1.39	1.40
29	1.19	1.21	1.23	1.24	1.26	1.27	1.29	1.30	1.31	1.32	1.33	1.34	1.35	1.36	1.37	1.38	1.39	1.40	1.41	1.42
30	1.22	1.24	1.26	1.27	1.28	1.30	1.31	1.32	1.34	1.35	1.36	1.37	1.38	1.39	1.40	1.41	1.42	1.43	1.44	1.45
31	1.24	1.26	1.28	1.29	1.31	1.32	1.33	1.35	1.36	1.37	1.38	1.39	1.40	1.41	1.42	1.43	1.44	1.45	1.46	1.47
32	1.27	1.30	1.30	1.32	1.34	1.35	1.37	1.38	1.41	1.42	1.43	1.44	1.45	1.46	1.47	1.48	1.49	1.50	1.51	1.52
33	1.29	1.31	1.33	1.34	1.36	1.37	1.39	1.40	1.42	1.44	1.45	1.46	1.47	1.48	1.49	1.50	1.51	1.52	1.53	1.54
34	1.32	1.34	1.36	1.37	1.38	1.40	1.41	1.42	1.44	1.45	1.46	1.47	1.48	1.49	1.50	1.51	1.52	1.53	1.54	1.55
35	1.33	1.35	1.37	1.38	1.40	1.42	1.44	1.45	1.46	1.47	1.48	1.49	1.50	1.51	1.52	1.53	1.54	1.55	1.56	1.57
36	1.35	1.37	1.39	1.40	1.42	1.44	1.45	1.46	1.47	1.48	1.49	1.50	1.51	1.52	1.53	1.54	1.55	1.56	1.57	1.58
37	1.37	1.39	1.41	1.42	1.44	1.46	1.47	1.48	1.51	1.52	1.53	1.54	1.55	1.56	1.57	1.58	1.59	1.60	1.61	1.62
38	1.38	1.41	1.43	1.44	1.46	1.48	1.51	1.52	1.53	1.54	1.55	1.56	1.57	1.58	1.59	1.60	1.61	1.62	1.63	1.64
39	1.40	1.43	1.45	1.47	1.48	1.49	1.52	1.53	1.54	1.55	1.56	1.57	1.58	1.59	1.60	1.61	1.62	1.63	1.64	1.65
40	1.42	1.45	1.47	1.48	1.51	1.52	1.53	1.54	1.55	1.56	1.57	1.58	1.59	1.60	1.61	1.62	1.63	1.64	1.65	1.66
41	1.44	1.47	1.49	1.51	1.52	1.53	1.54	1.55	1.56	1.57	1.58	1.59	1.60	1.61	1.62	1.63	1.64	1.65	1.66	1.67
42	1.46	1.49	1.51	1.52	1.53	1.54	1.55	1.56	1.57	1.58	1.59	1.60	1.61	1.62	1.63	1.64	1.65	1.66	1.67	1.68
43	1.48	1.51	1.53	1.54	1.55	1.56	1.57	1.58	1.59	1.60	1.61	1.62	1.63	1.64	1.65	1.66	1.67	1.68	1.69	1.70
44	1.50	1.52	1.54	1.55	1.56	1.57	1.58	1.59	1.60	1.61	1.62	1.63	1.64	1.65	1.66	1.67	1.68	1.69	1.70	1.71
45	1.52	1.54	1.56	1.57	1.58	1.59	1.60	1.61	1.62	1.63	1.64	1.65	1.66	1.67	1.68	1.69	1.70	1.71	1.72	1.73
46	1.54	1.56	1.58	1.59	1.60	1.61	1.62	1.63	1.64	1.65	1.66	1.67	1.68	1.69	1.70	1.71	1.72	1.73	1.74	1.75
47	1.56	1.58	1.60	1.61	1.62	1.63	1.64	1.65	1.66	1.67	1.68	1.69	1.70	1.71	1.72	1.73	1.74	1.75	1.76	1.77
48	1.58	1.60	1.62	1.63	1.64	1.65	1.66	1.67	1.68	1.69	1.70	1.71	1.72	1.73	1.74	1.75	1.76	1.77	1.78	1.79
49	1.60	1.62	1.64	1.65	1.66	1.67	1.68	1.69	1.70	1.71	1.72	1.73	1.74	1.75	1.76	1.77	1.78	1.79	1.80	1.81
50	1.62	1.64	1.66	1.67	1.68	1.69	1.70	1.71	1.72	1.73	1.74	1.75	1.76	1.77	1.78	1.79	1.80	1.81	1.82	1.83
51	1.64	1.66	1.68	1.69	1.70	1.71	1.72	1.73	1.74	1.75	1.76	1.77	1.78	1.79	1.80	1.81	1.82	1.83	1.84	1.85
52	1.66	1.68	1.70	1.71	1.72	1.73	1.74	1.75	1.76	1.77	1.78	1.79	1.80	1.81	1.82	1.83	1.84	1.85	1.86	1.87
53	1.68	1.70	1.72	1.73	1.74	1.75	1.76	1.77	1.78	1.79	1.80	1.81	1.82	1.83	1.84	1.85	1.86	1.87	1.88	1.89
54	1.70	1.72	1.74	1.75	1.76	1.77	1.78	1.79	1.80	1.81	1.82	1.83	1.84	1.85	1.86	1.87	1.88	1.89	1.90	1.91
55	1.72	1.74	1.76	1.77	1.78	1.79	1.80	1.81	1.82	1.83	1.84	1.85	1.86	1.87	1.88	1.89	1.90	1.91	1.92	1.93
56	1.74	1.76	1.78	1.79	1.80	1.81	1.82	1.83	1.84	1.85	1.86	1.87	1.88	1.89	1.90	1.91	1.92	1.93	1.94	1.95

CAMEL CACTUS YIELD TABLE  
 UPLAND LOAM RANGE SITE - FAIR CONDITION  
 Pounds Air Dry

TABLE J

Foliage Area Sq. Ft.	Basal Area Sq. In.																						
	.50	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00	11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00	19.00	20.00	21.00	
.50	.04	.05	.06	.06	.06	.07	.07	.07	.08	.08	.08	.08	.08	.08	.08	.08	.09	.09	.09	.09	.09	.09	.09
1	.07	.08	.08	.09	.10	.10	.10	.11	.12	.12	.12	.12	.12	.13	.13	.13	.13	.13	.14	.14	.14	.14	.14
2	.10	.12	.12	.13	.15	.15	.16	.16	.17	.18	.18	.18	.19	.19	.19	.19	.19	.19	.20	.20	.20	.20	.20
3	.13	.15	.16	.18	.20	.20	.21	.22	.22	.23	.24	.24	.24	.25	.25	.26	.26	.26	.26	.27	.27	.27	.27
4	.16	.18	.20	.22	.24	.26	.26	.28	.28	.28	.29	.30	.30	.31	.31	.32	.32	.32	.33	.34	.34	.34	.34
5	.19	.22	.24	.26	.29	.31	.32	.33	.33	.34	.35	.36	.36	.37	.37	.38	.38	.38	.39	.40	.40	.40	.40
6	.21	.25	.27	.29	.32	.35	.36	.37	.37	.38	.39	.40	.40	.41	.41	.42	.43	.43	.44	.45	.45	.45	.45
7	.24	.27	.30	.32	.36	.38	.39	.41	.41	.42	.43	.44	.45	.45	.46	.47	.47	.48	.48	.49	.50	.50	.50
8	.26	.30	.32	.36	.39	.42	.43	.44	.45	.47	.48	.49	.49	.50	.50	.51	.52	.52	.53	.54	.55	.55	.55
9	.29	.32	.35	.39	.43	.45	.46	.48	.49	.51	.52	.53	.54	.54	.55	.56	.56	.57	.57	.58	.60	.60	.60
10	.31	.35	.38	.42	.46	.49	.50	.52	.53	.55	.56	.57	.58	.58	.59	.60	.61	.62	.62	.63	.64	.64	.64
11	.33	.37	.40	.44	.48	.52	.53	.55	.56	.58	.59	.60	.61	.62	.62	.64	.65	.66	.66	.67	.68	.68	.68
12	.35	.39	.43	.47	.51	.54	.56	.58	.59	.61	.63	.64	.65	.65	.66	.67	.68	.69	.69	.71	.72	.72	.72
13	.36	.41	.45	.49	.54	.57	.59	.61	.62	.64	.66	.67	.68	.68	.70	.71	.72	.73	.73	.75	.76	.76	.76
14	.38	.43	.47	.52	.56	.60	.62	.64	.65	.67	.69	.70	.72	.72	.73	.74	.75	.76	.77	.79	.80	.80	.80
15	.40	.46	.50	.54	.58	.62	.64	.66	.68	.70	.72	.74	.75	.76	.76	.78	.79	.80	.80	.82	.82	.83	.83
16	.42	.48	.52	.56	.61	.65	.67	.69	.72	.74	.76	.77	.78	.79	.80	.82	.83	.84	.84	.86	.86	.87	.87
17	.44	.50	.54	.59	.64	.68	.70	.72	.75	.77	.79	.80	.82	.82	.84	.85	.86	.87	.88	.90	.90	.91	.91
18	.45	.52	.56	.61	.66	.71	.73	.75	.78	.80	.82	.83	.85	.86	.87	.89	.90	.91	.92	.94	.94	.95	.95
19	.47	.54	.59	.64	.68	.73	.76	.78	.81	.83	.86	.87	.89	.90	.90	.92	.93	.94	.95	.98	.98	.99	.99
20	.49	.56	.61	.66	.71	.76	.79	.81	.84	.86	.89	.90	.92	.93	.94	.96	.97	.98	.99	1.01	1.02	1.03	1.03
21	.51	.58	.63	.68	.73	.79	.82	.84	.87	.89	.92	.93	.95	.96	.97	.99	1.00	1.01	1.02	1.05	1.06	1.06	1.06
22	.52	.60	.65	.70	.76	.81	.84	.86	.90	.92	.95	.96	.98	.99	1.00	1.02	1.03	1.04	1.05	1.08	1.08	1.09	1.09
23	.54	.61	.67	.73	.78	.84	.87	.89	.92	.95	.98	.99	1.01	1.02	1.03	1.05	1.06	1.07	1.09	1.12	1.12	1.13	1.13
24	.55	.63	.69	.75	.81	.86	.89	.92	.95	.98	1.01	1.02	1.04	1.05	1.06	1.08	1.09	1.10	1.12	1.15	1.16	1.16	1.16
25	.57	.65	.71	.77	.83	.89	.92	.94	.98	1.00	1.04	1.05	1.06	1.08	1.09	1.11	1.12	1.14	1.15	1.18	1.18	1.19	1.19
26	.59	.67	.73	.79	.85	.92	.95	.97	1.01	1.03	1.06	1.08	1.09	1.11	1.12	1.14	1.16	1.17	1.18	1.21	1.22	1.22	1.22
27	.60	.69	.75	.81	.88	.94	.97	1.00	1.04	1.06	1.09	1.11	1.12	1.14	1.15	1.17	1.19	1.20	1.21	1.24	1.24	1.25	1.25
28	.62	.70	.77	.84	.90	.97	1.00	1.03	1.06	1.09	1.12	1.14	1.15	1.17	1.18	1.20	1.22	1.23	1.25	1.28	1.28	1.29	1.29
29	.63	.72	.79	.86	.93	.99	1.02	1.05	1.09	1.12	1.15	1.17	1.18	1.20	1.21	1.23	1.24	1.26	1.28	1.31	1.32	1.32	1.32
30	.65	.74	.81	.88	.95	1.02	1.05	1.08	1.12	1.15	1.18	1.20	1.21	1.23	1.24	1.26	1.28	1.29	1.31	1.32	1.34	1.35	1.35
31	.68	.76	.83	.90	.97	1.04	1.07	1.10	1.14	1.17	1.20	1.22	1.24	1.26	1.27	1.29	1.31	1.32	1.34	1.37	1.38	1.38	1.38
32	.68	.77	.84	.92	.99	1.06	1.09	1.13	1.16	1.20	1.23	1.25	1.26	1.28	1.29	1.31	1.33	1.34	1.36	1.40	1.40	1.41	1.41
33	.69	.79	.86	.93	1.01	1.08	1.12	1.15	1.19	1.22	1.25	1.27	1.28	1.30	1.32	1.34	1.36	1.37	1.39	1.42	1.42	1.43	1.43
34	.71	.80	.88	.95	1.03	1.10	1.14	1.17	1.21	1.24	1.28	1.30	1.31	1.33	1.34	1.36	1.38	1.40	1.42	1.45	1.46	1.46	1.46
35	.72	.82	.90	.97	1.05	1.12	1.16	1.20	1.23	1.26	1.30	1.32	1.34	1.36	1.37	1.39	1.41	1.42	1.44	1.48	1.48	1.49	1.49
36	.73	.84	.91	.99	1.07	1.15	1.18	1.22	1.25	1.29	1.32	1.34	1.36	1.38	1.40	1.42	1.44	1.45	1.47	1.51	1.52	1.52	1.52
37	.75	.85	.93	1.01	1.09	1.17	1.20	1.24	1.27	1.31	1.35	1.37	1.38	1.40	1.42	1.44	1.46	1.48	1.50	1.54	1.54	1.55	1.55
38	.76	.87	.95	1.02	1.11	1.19	1.23	1.26	1.30	1.33	1.37	1.39	1.41	1.43	1.45	1.47	1.49	1.51	1.53	1.56	1.56	1.57	1.57
39	.78	.88	.96	1.04	1.13	1.21	1.25	1.29	1.32	1.36	1.40	1.42	1.44	1.46	1.47	1.49	1.51	1.53	1.55	1.59	1.60	1.60	1.60
40	.79	.90	.98	1.06	1.15	1.23	1.27	1.31	1.34	1.38	1.42	1.44	1.46	1.48	1.50	1.52	1.54	1.56	1.58	1.60	1.62	1.63	1.63
50	.91	1.04	1.13	1.24	1.34	1.43	1.47	1.51	1.56	1.60	1.64	1.66	1.69	1.71	1.74	1.76	1.78	1.81	1.83	1.86	1.88	1.90	1.90
60	1.03	1.18	1.29	1.40	1.51	1.62	1.66	1.70	1.73	1.77	1.81	1.84	1.87	1.91	1.94	1.97	2.00	2.03	2.07	2.10	2.13	2.15	2.15

CANDEL OAKBRUSH YIELD TABLE  
 UPLAND LOAM RANGE SITE - FAIR CONDITION  
 Pounds Air Dry

TABLE J (Cont'd.)

Foliage Area Sq. Ft.	Basal Area Sq. in.																				
	22.00	23.00	24.00	25.00	26.00	27.00	28.00	29.00	30.00	31.00	32.00	33.00	34.00	35.00	36.00	37.00	38.00	39.00	40.00	50.00	60.00
.50	.09	.09	.09	.09	.09	.09	.09	.09	.09	.09	.09	.09	.09	.10	.10	.10	.10	.10	.10	.10	.11
1	.14	.14	.14	.14	.15	.15	.15	.15	.15	.15	.15	.15	.15	.16	.16	.16	.16	.16	.16	.16	.17
2	.21	.21	.21	.21	.22	.22	.22	.22	.22	.22	.22	.22	.22	.23	.23	.23	.24	.24	.24	.24	.25
3	.28	.28	.28	.28	.28	.29	.29	.30	.30	.30	.30	.30	.30	.30	.30	.30	.31	.31	.31	.32	.34
4	.34	.34	.35	.35	.35	.36	.36	.37	.37	.37	.37	.38	.38	.38	.38	.38	.38	.38	.38	.40	.42
5	.41	.41	.42	.42	.42	.43	.43	.44	.44	.44	.44	.45	.45	.45	.45	.45	.46	.46	.46	.48	.50
6	.46	.46	.47	.47	.47	.48	.48	.49	.49	.49	.50	.50	.50	.50	.50	.50	.51	.51	.51	.54	.56
7	.51	.51	.52	.52	.52	.53	.53	.54	.54	.54	.54	.55	.55	.55	.55	.56	.56	.57	.57	.60	.62
8	.55	.56	.56	.56	.57	.58	.58	.58	.59	.59	.60	.60	.61	.61	.61	.61	.62	.62	.62	.65	.68
9	.60	.61	.61	.61	.62	.63	.63	.63	.64	.64	.64	.65	.66	.66	.66	.67	.67	.68	.68	.71	.74
10	.65	.66	.66	.66	.67	.68	.68	.68	.69	.69	.70	.70	.71	.71	.71	.72	.72	.73	.73	.77	.80
11	.69	.70	.70	.70	.71	.72	.72	.72	.73	.73	.74	.74	.75	.75	.75	.76	.76	.77	.77	.82	.85
12	.73	.74	.74	.74	.75	.76	.76	.76	.77	.77	.78	.78	.79	.80	.80	.80	.81	.82	.82	.86	.89
13	.77	.77	.78	.78	.79	.80	.80	.80	.81	.82	.82	.83	.84	.84	.84	.84	.85	.86	.86	.90	.94
14	.81	.81	.82	.82	.83	.84	.84	.84	.85	.86	.86	.87	.88	.88	.88	.89	.90	.90	.91	.95	.98
15	.84	.85	.86	.86	.87	.88	.88	.88	.90	.90	.90	.91	.92	.92	.92	.93	.94	.94	.95	1.00	1.03
16	.88	.89	.89	.90	.91	.92	.92	.93	.94	.94	.95	.95	.96	.97	.97	.98	.98	.99	.99	1.04	1.08
17	.92	.93	.93	.94	.95	.96	.96	.97	.98	.98	.99	.99	1.00	1.01	1.01	1.02	1.03	1.03	1.04	1.08	1.12
18	.96	.96	.97	.98	.99	1.00	1.00	1.01	1.02	1.03	1.03	1.04	1.05	1.05	1.05	1.06	1.07	1.07	1.08	1.13	1.17
19	1.00	1.00	1.01	1.02	1.03	1.04	1.04	1.05	1.06	1.07	1.07	1.08	1.09	1.10	1.10	1.11	1.12	1.12	1.13	1.18	1.21
20	1.04	1.04	1.05	1.06	1.07	1.08	1.08	1.09	1.10	1.11	1.12	1.12	1.13	1.14	1.14	1.15	1.16	1.16	1.17	1.22	1.26
21	1.07	1.07	1.08	1.09	1.10	1.11	1.12	1.12	1.14	1.14	1.15	1.16	1.16	1.18	1.18	1.19	1.20	1.20	1.21	1.26	1.30
22	1.10	1.11	1.12	1.13	1.14	1.15	1.15	1.16	1.17	1.18	1.18	1.19	1.20	1.21	1.21	1.22	1.23	1.23	1.24	1.30	1.34
23	1.14	1.14	1.15	1.16	1.17	1.18	1.18	1.20	1.20	1.22	1.22	1.22	1.24	1.24	1.25	1.26	1.26	1.27	1.28	1.33	1.38
24	1.17	1.17	1.18	1.20	1.21	1.22	1.22	1.23	1.24	1.25	1.25	1.26	1.27	1.28	1.28	1.29	1.30	1.30	1.31	1.37	1.42
25	1.20	1.20	1.22	1.23	1.24	1.25	1.26	1.26	1.28	1.28	1.29	1.30	1.30	1.32	1.32	1.33	1.34	1.34	1.35	1.41	1.46
26	1.23	1.24	1.25	1.26	1.27	1.28	1.29	1.30	1.31	1.32	1.33	1.33	1.34	1.35	1.36	1.36	1.37	1.38	1.39	1.45	1.50
27	1.26	1.26	1.28	1.30	1.31	1.32	1.32	1.34	1.34	1.36	1.36	1.36	1.38	1.38	1.39	1.40	1.40	1.41	1.42	1.49	1.54
28	1.30	1.30	1.31	1.33	1.34	1.35	1.36	1.37	1.38	1.39	1.40	1.40	1.41	1.42	1.43	1.44	1.44	1.45	1.46	1.52	1.58
29	1.33	1.34	1.35	1.37	1.38	1.39	1.40	1.40	1.42	1.42	1.43	1.44	1.44	1.46	1.46	1.47	1.48	1.48	1.49	1.56	1.62
30	1.36	1.37	1.38	1.40	1.41	1.42	1.43	1.44	1.45	1.46	1.47	1.47	1.48	1.49	1.50	1.51	1.51	1.52	1.53	1.60	1.66
31	1.39	1.40	1.41	1.43	1.44	1.45	1.46	1.47	1.48	1.49	1.50	1.50	1.51	1.52	1.53	1.54	1.54	1.55	1.56	1.63	1.70
32	1.42	1.43	1.44	1.46	1.47	1.48	1.49	1.50	1.51	1.52	1.53	1.53	1.54	1.55	1.56	1.57	1.58	1.59	1.60	1.67	1.73
33	1.45	1.46	1.47	1.49	1.50	1.51	1.52	1.53	1.54	1.55	1.56	1.57	1.58	1.59	1.60	1.61	1.61	1.62	1.63	1.70	1.77
34	1.48	1.49	1.50	1.52	1.53	1.54	1.55	1.56	1.57	1.58	1.59	1.60	1.61	1.62	1.63	1.64	1.64	1.65	1.66	1.74	1.80
35	1.50	1.52	1.53	1.54	1.56	1.57	1.58	1.60	1.60	1.62	1.62	1.63	1.64	1.65	1.66	1.67	1.68	1.68	1.70	1.77	1.84
36	1.53	1.54	1.56	1.57	1.58	1.60	1.61	1.63	1.64	1.65	1.66	1.66	1.67	1.68	1.69	1.70	1.71	1.72	1.73	1.80	1.88
37	1.56	1.57	1.59	1.60	1.61	1.63	1.64	1.66	1.67	1.68	1.69	1.69	1.70	1.71	1.72	1.73	1.74	1.75	1.76	1.84	1.91
38	1.59	1.60	1.62	1.63	1.64	1.66	1.67	1.69	1.70	1.71	1.72	1.73	1.74	1.75	1.76	1.77	1.77	1.78	1.79	1.87	1.95
39	1.62	1.63	1.64	1.66	1.67	1.69	1.70	1.72	1.73	1.74	1.75	1.76	1.77	1.78	1.79	1.80	1.81	1.82	1.83	1.91	1.98
40	1.65	1.66	1.68	1.69	1.70	1.72	1.73	1.75	1.76	1.77	1.78	1.79	1.80	1.81	1.82	1.83	1.84	1.85	1.86	1.94	2.02
50	1.91	1.93	1.94	1.96	1.98	1.99	2.01	2.02	2.04	2.05	2.06	2.08	2.09	2.10	2.11	2.12	2.14	2.15	2.16	2.26	2.31
60	2.17	2.18	2.20	2.22	2.24	2.26	2.27	2.29	2.31	2.32	2.34	2.35	2.36	2.38	2.39	2.40	2.41	2.43	2.44	2.55	2.63

#### 4.2 Productivity

Only topsoil will be used, according to the reclamation plan outlined in Chapter III, Part E re Reclamation.

#### 5. Topsoil Handling During Operations

##### 5.1 Removal

The area from which topsoil was removed is approximately 30 acres and includes poorly developed soils. Using dozers and front end loaders, the soil was scraped from the surface and dumped at a site near the facility location. The topsoil was removed as a separate operation from areas to be disturbed by surface installations such as roads and areas upon which support facilities are sited.

##### 5.2 Storage

The topsoil storage area is shown on Plate 6. The topsoil has been segregated, stockpiled, and protected from wind and water erosion and contaminants through revegetation and the use of berms.

#### 6. Reclamation of Topsoil and Substitute

Disturbed areas no longer required for the conduct of mining operations have been revegetated. Upon completion of mining activities, topsoil will be distributed and reclamation will commence as outlined in Chapter III, Part E re Reclamation. Andalex will adhere to all UDOGM guidelines.

#### G. Alluvial Valley Floors

The permit area is not located in the presence of an alluvial valley floor.

#### H. Land Use Information and Post-Mining Land Use

##### 1. Introduction

Due to the rugged topography and sparse rainfall, the land area is presently used only for grazing, wildlife habitat, and outdoor recreation. Historically, the land has also been used for coal mining.

##### 2. Condition, Capability, and Productivity of the Land

Livestock grazing has been the most intense use of the lease area. However, due to the expansive cliff formations and the roughness of the canyon walls, grazing has been principally limited to the canyon bottoms and extreme tops to the north of the lease boundary.

Mule deer are found within the lease area as well as the usual small mammals, predators, and passerine and raptorial birds.

Outdoor recreation in the lease area is limited and usually related to enjoyment of the open space and associated scenic facilities and hunting for wild animals. The number of people using the area is small due to the rough terrain, poor roads, and lack of water.

3. Past Mining

The initial development of the Book Cliffs Coal Field was started in the early 1890's. By the early 1900's practically the entire field had been prospected. Mines in the lease area were not active until the 1920's because the cliffs were less accessible and the coal beds were thinner.

The Knight-Ideal mines, now held by Eureka Energy Corp., are located approximately two miles east of the lease area. Initial prospecting took place at this location in 1906 and extensive mining began in 1948 and ceased in 1958. During this period, 1,680,000 tons of coal were produced from the Gilson seam.

Three mines on or adjacent to the lease area in Deadman Canyon were the Zion, Olsen, and Sutton (Blue Flame) mines. The Zion was located on the Zion's fee lease and the Olsen and Sutton were on SL-027304. The first two produced from the Gilson seam and the last produced from the Aberdeen or Castlegate "A" seam. Production figures are not reliable but it is estimated that between 216,000 tons and 720,000 tons may have been produced from the Sutton mines. The Olsen mines produced about 18,000 tons and the Zion mine around 240,000 tons, between 1924 and 1944.

There was also a prospect entry driven in the Lower Sunnyside Seam (the Hileman) on lease U-010581 from which production was insignificant, approximately 1,400 tons. Mining ceased in the area in 1964.

4. Existing Use

The Deadman Canyon area would fall into two land use categories: 1) Fish and Wildlife habitat and recreation lands, and 2) Range lands. County zoning regulations (1974) indicate all lands involved in the lease application area are within zone M and G1 which is for mining and grazing. Current land use consists of grazing and deer hunting. For recreational purposes the land is suitable only for deer hunting. The snow cover is too light and slopes too steep for snowmobiling, cross-country skiing, and snow shoeing. The lack of water prevents the establishment of a chukkar/partridge population. Usually there are no elk in the area although an animal or two may occasionally wander onto the area.

There are no oil and gas wells or water wells other than those water wells drilled by Andalex for use in mining activities, on the lease area.

The area is eight air miles from Price, but the unavailability of water precludes any development for residential or summer homes.

## 5. Impacts of Operations

### 5.1 Socioeconomic Impacts

The proposed project is located in an area where coal mining is the major industry, therefore, the community is geared for coal operations. The labor supply is excellent, well-trained, and available. Most people in this area have a very favorable attitude towards the increased coal activity. They look forward to growth in the area which will increase population, home construction, and provide other facilities for community use.

The need for development of additional housing, school space, and changes in present community services would be among the greatest impacts, due to the increase in population. Positive effects of the project will be to increase the number of jobs, payroll, and taxes thus helping to build the community.

### 5.2 Land Use Changes

The nature of an underground mine of this type and size requires minimal surface disturbance. The limited resources both physical and scenic will dictate no future change in land status. Considering the extent and nature of similar lands in the Book Cliffs, no uses other than those previously discussed can be forecast.

Deadman Canyon has been unsightly since the earliest mining began in the 1920's the new mine surface facility and portal site will be in the same area as the old mine tipples and waste dumps. These waste dumps are numerous and located throughout the canyon bottom and consist of coal fines which were unmarketable during the earlier mining history. This coal waste has been recovered, reprocessed, and cleaned up during the new operation. This new operation will actually be a significant reclamation phase to the canyon area.

During and after completion of mining operations, the land will continue to be used for grazing and hunting. No future change is dictated in the land status. Surface disturbances will be very minimal and all disturbed land will be restored in a timely manner, according to the Reclamation Plan outlined in Chapter III, to conditions that are capable of supporting the uses they were capable of supporting before mining.

6. Post-Mining Land Use

6.1 Comments of Owners of Surface Disturbed Areas and State and Local Agencies

As there are no proposed land use changes and minimal surface disturbance, there have been no negative comments from legal or equitable owners of record of surface areas to be affected or from any state or local agencies.

6.2 Consideration given to Comments

The proposed mining activities are consistent with surface owner plans and state and local land use plans. However, full consideration will be given to any future comments concerning this mining activity.

6.3 Methods to Achieve Post-Mining Land Use

As previously discussed, there will be minimal surface disturbances and no change in land use. As discussed in Part H, Section 5.2 of this Chapter re Land Use Changes, this operation will be a significant reclamation phase in the Deadman Canyon area. All disturbed areas shall be reclaimed and revegetated as described in Chapter III, Part E re Reclamation and Chapter IV, Part D, Section 5 re Revegetation Plan.

I. Cultural and Historic Resources

1. Identification and Description of Resources

1.1 Archaeology

To assure that no archaeological or historical sites existed in the proposed permit area, which would be impacted by the development of the coal resources, two reconnaissance surveys have been conducted.

The Department of Anthropology and Archaeology of Brigham Young University was employed to conduct a survey of the Deadman Canyon Area. A report of this survey by Terry Walker, prepared under the direction of Professor Ray T. Matheny of Brigham Young University is attached as Appendix C. A survey of Fiasco Canyon, Starpoint Canyon, and Straight Canyon was conducted by the Consulting Services Branch of the Antiquities Section, Division of State History, Salt Lake City, Utah. A report of this survey was prepared by Bruce Hawkins and Gregory S. Seward under the supervision of Asa S. Nielson and is also attached as Appendix C.

Authorization to conduct these surveys was granted by the Bureau of Land Management, as the majority of the surface described above is under the jurisdiction of the B.L.M.

Prior to these investigations, no recorded archaeological studies of any kind had ever been done in the survey area.

In the Deadman Canyon area study by Walker, no archaeological or historical sites were found. In the Fiasco-Straight Canyon study by Hawkins and Seward, six historic sites were encountered, early 20th century construction associated with mining, and a seventh site was historic graffiti. All were lacking National Register qualifications. In the opinion of the Archaeologists performing the studies, none of the sites encountered should impede development.

1.2 Paleontology

The project area has not been surveyed for paleontological resources. However, the mine plan area is located in a potential fossil-bearing area of slight value according to the United States Department of the Interior, Final Environmental Statement, Development of Coal Resources in Central Utah, Regional Analysis Part 1, Figure II-7 (Map of central Utah vertebrate and plant fossil bearing area.)

1.3 Public Parks

There are no public parks in the proposed permit area or nearby vicinity.

1.4 Other

No other cultural or historic resources are known to exist in the area.

2. Protection

Since there are no public parks or archaeological or historic sites which will be adversely affected by the proposed operation, no specific protection plan is deemed necessary.

## VOLUME II

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2.	Surface Ownership
3.	Book Cliffs Mineral Ownership
4.	Leases
5.	Surface Area Boundry
6.	As Constructed Surface Facilities - Deadman Canyon
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14.	Cut & Fill Cross Section Reference
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36.	Plan Pond A
37.	Cross Section Pond A
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39.	Cross Section Temporary Topsoil Storage
40.	Deadman Canyon Top Soil Storage Piles

## VI. Preparation of Application

### A. Persons and Consultants Involved

The following persons and/or organizations were involved in collection and analysis of the technical data set forth in this application.

#### 1. In House Consulting Services

- a) Andalex Resources, Inc. - AMCA Coal Leasing, Inc.  
Samuel C. Quigley - Western Project Manager  
Michael W. Glasson - Senior Geologist  
Allen D. Emmel - Environmental Planning Coordinator

#### 2. Outside Consulting Services

- a) Dan W. Guy - Registered Professional Engineer  
(State of Utah No. 4548)  
Price, Utah  
-Sedimentation and Drainage Control Plan (April 1980)  
-Wastewater Disposal System; Pinnacle Mine (April 1980),  
Office Building (September 1980)
- b) Bruce T.S. Ware - Registered Land Surveyor  
Price, Utah
- c) A and W Surveying  
Price, Utah
- d) Commercial Testing and Engineering Co.  
Denver, Colorado
- e) Standard Laboratories  
Huntington, Utah
- f) Western Testing and Engineering  
Helper, Utah
- g) VanCott, Bagely, Cornwall and McCarthy  
Attorneys at Law  
Salt Lake City, Utah
- h) Rollins, Brown, and Gunnel  
Provo, Utah
- i) Brigham Young University  
Provo, Utah  
Department of Zoology  
Clayton M. White  
(Raptor Study)  
Department of Anthropology/Archaeology  
Dr. Ray T. Matheny  
(Archaeological Survey)
- j) Earth Environmental Consultants Albuquerque,  
New Mexico.

k) Vaughn Hansen Associates  
Salt Lake City, Utah  
(Hydrology Study)

B. Coordination and Consultation with Governmental Agencies

The following governmental agencies were consulted in the preparation of information set forth in this application.

U.S. Department of Agriculture  
Soil Conservation Service  
Price, Utah  
(Soil and Vegetation Survey)

U.S. Department of the Interior  
Bureau of Land Management  
Price, Utah  
Salt Lake City, Utah

Office of Surface Mining, Reclamation and Enforcement  
Denver, Colorado

U.S. Geological Survey  
Salt Lake City, Utah

State of Utah  
Department of Natural Resources  
Division of Oil, Gas, and Mining  
Salt Lake City, Utah

Antiquities Section (Consulting Services Branch)  
Salt Lake City, Utah  
(Archaeological Survey)

Department of Natural Resources  
Division of Fish and Wildlife  
Salt Lake City, Utah

C. References

AMCA Coal Leasing, Inc., 1978. Mining and Reclamation Plan, Zion's Fee. Submitted to the State of Utah, Department of Natural Resources, D.O.G.M.

Centennial Coal Associates, 1976. Mining Application. Submitted to the U.S. Geological Survey.

Doelling, H.H., 1972. Central Utah Coal Fields. U.G.M.S. Monograph Series No. 3.

U.S.D.A., 1978. Soil Survey and Interpretations of the Coal Creek Emery Portion of the Price River and Emery County Areas, Carbon and Emery Counties, Utah. S.C.S.

U.S.D.I., 1979. Final Environmental Statement, Development of Coal Resources in Central Utah, Parts 1 and 2.

U.G.M.S., 1966. Central Utah Coals. U.G.M.S. Bulletin No. 80.

VII. Cross Reference Table - Regulation in 30 CFR, Chapter VII.

The cross reference tables appearing here are included to provide a rapid completeness check of this application by the reviewer.

1. Part 782 - Legal, Financial, Compliance, and Related Information.

<u>Regulatory Paragraph</u>	<u>Text Reference</u>
782.13	Page 7
782.14	12
782.15	12
	14
782.16	14
782.17	15
782.18	15
782.19	17
782.20	17
782.21	

2. Part 783 - Environmental Resources

<u>Regulatory Paragraph</u>	<u>Text Reference</u>
783.12	74
783.13	74
783.14	74
783.15	114
783.16	135
783.17	NA
783.18	200
783.19	210
783.20	217, Appendix A
783.21	254
783.22	324
783.24	329
783.25	329
783.27	39

3. Part 784 - Reclamation and Operation Plan

<u>Regulatory Paragraph</u>	<u>Text Reference</u>
784.11	18
784.12	19
784.13	61

<u>Regulatory Paragraph</u>	<u>Text Reference</u>
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784.14	36
784.15	61
784.16	61
784.17	NA
784.18	39
784.19	39
784.20	36
784.21	Appendix A
784.22	166
784.23	329
784.24	Appendix K
784.25	24
784.26	NA

4. Part 785 - Special Mining Categories

<u>Regulatory Paragraph</u>	<u>Text Reference</u>
-----------------------------	-----------------------

785.11-16	NA
785.17	39
785.18	NA
785.19	324
785.20	NA
785.21	NA
785.22	NA

B. Subchapter J (Parts 800-806) - Bonding and Insurance

<u>Regulatory Paragraph</u>	<u>Text Reference</u>
-----------------------------	-----------------------

800	70, Appendix K
805	NA
806	NA

C. Subchapter K (Parts 817-828) - Performance Standards

Regulatory ParagraphText Reference

817.11	26
817.13-15	62, Appendix L
817.21	254, Appendix K
817.22	324, Appendix K
817.23	324, Appendix K
817.24	324, Appendix K
817.41-50	108, Appendix L
817.52	Appendix L
817.53-55	Appendix L
817.56	B, Appendix L
817.57	NA
817.59	26
817.61-68	NA
817.71	39
817.72-93	NA
817.95	38
817.97	217, Appendix K
817.99	Appendix K
817.100-117	213, Appendix K
817.121-126	25
817.131-132	Appendix K
817.133	324
817.150-180	Appendix K
817.181	19, Appendix K

APPENDICES

Appendix A ..... Wildlife Resources Information

Appendix B ..... Permits, Violations, Insurance & Bond

Appendix C ..... Archaeological Information

Appendix D ..... Raptor Survey

Appendix E ..... Coal Quality & Drill Hole Logs

Appendix F ..... Emission Inventory

Appendix G ..... Wastewater Disposal System

Appendix H ..... Water Well Information & Water Quality

Appendix I ..... Power Line & Substation Design

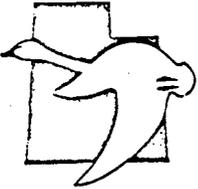
Appendix J ..... Other Approvals

Appendix K ..... Response to Completeness Review, September 21, 1987  
(Excluding Hydrology Section)

Appendix L ..... Response to Completeness Review, October 5, 1987  
Hydrology Section

Appendix A

WILDLIFE RESOURCES INFORMATION



# DIVISION OF WILDLIFE RESOURCES

DOUGLAS F. DAY  
Director

EQUAL OPPORTUNITY EMPLOYER

1596 West North Temple/Salt Lake City, Utah 84116/801-533-9333

April 13, 1981

Reply To SOUTHEASTERN REGIONAL OFFICE  
455 West Railroad Avenue, Box 840, Price, Utah 84501  
(801) 637-3310

Mr. Sam Quigley  
Tower Resources Inc.  
Centennial Mining Project  
82 West Main  
Price, Utah 84501

Attention: Mike Glasson

Dear Sam:

I want to take this opportunity to extend thanks for the assistance you and Mike have provided our staff in becoming familiar with existing and planned surface facilities on the area encompassed by Tower Resources Inc.'s Centennial Mining Project. I believe that you will find the enclosed information helpful at filing a mine and reclamation plan.

In response to your request for wildlife resource information (UMC 783.20) the attached map, data and comments are provided. The wildlife resource information is consistent with the formal guidelines for acquisition of fish, wildlife and habitat information that will be provided your Company by Utah's Division of Oil, Gas and Mining. In instances where your Company was or will be required to provide for study beyond existing information, such findings need be appended to this report.

Please note that the enclosed wildlife plan (UMC 784.21) represents our recommendations; Utah's Division of Oil, Gas and Mining is the regulatory authority for approval of the mining and reclamation plan. Implementation of the recommended wildlife plan should assist the Company in compliance with performance standards UMC 817.97.

Thank you for an opportunity to assist your Company in complying with the State's permanent program for coal mining and reclamation and the resultant protection of Utah's wildlife resources. If the Division can be of any further service, please coordinate with our Regional Resource Analyst (Larry Dalton, phone 801-637-3310) as appropriate.

Sincerely,

*John Livesay*  
John Livesay, Supervisor  
Southeastern Region

JL:LBD:gp

Enclosure

cc: ~~SOV 5/28/81~~ Darrell Nish Clark Johnson  
Gordon E. Harmston  
Leon Berggren  
Exec Director

WILDLIFE BOARD  
Roy L. Young - Chairman  
Lynn C. Smith  
Walter T. ...

UMC 784.21; FISH AND WILDLIFE PLAN  
TOWER RESOURCES INC., CENTENIAL MINING PROJECT

Mitigation and Impact Avoidance Procedures General to all Wildlife

Utah Division of Wildlife Resources provides the following recommendations in order to minimize disturbances and impacts on wildlife and their habitats that could be impacted during developmental, operational and reclamation operations at the Company's mining project. The recommendations address how enhancement of the wildlife resource and their habitats as discussed in UMC 783.20 can be achieved. They are also consistent with the performance standards of UMC 817.97. In instances where it would be necessary to restore or could be beneficial to enhance or develop high value habitats for fish and wildlife, recommended plant materials and rates of application are provided as "Appendix B" (UMC 817.97 and UMC 817.111 through 817.117). This list should prove useful in meeting the additional requirements to be imposed upon the operator if the primary or secondary land use will be for wildlife habitats (UMC 817.97 d 9). Additionally, "Appendix C" represents a list of commercial sources for plant materials.

The project and adjacent areas are represented by seven basic wildlife habitats which are inhabited on occasion and during different seasons of the year by about 184 species of vertebrate wildlife. The wildlife habitats and use areas for the "high interest" species from this group of wildlife have been ranked into four levels of importance. The most valuable to an individual species or ecological assemblage are the critical sites followed in respective importance by high-priority, substantial value and limited value sites. Each type of use area requires various and specific levels of protection from man's activities. Additionally, due to the variability of vegetation communities in each use area, various and specific technologies in site development will need to be evaluated for possible mitigations, enhancements of wildland habitats or the required level of reclama-

tion. It is recommended that all land clearing impacts be designed so that irregular shaped openings are created in contrast to openings that would have straight edges.

It is recommended that the Company make significant efforts to educate all employees associated with their coal handling operation of the intricate values of the wildlife resource associated with the project and adjacent areas and the local area. Each employee should be advised not to unnecessarily or without proper permits harass or take any wildlife. (Apprehension of wildlife violators has increased by nearly 250 percent during recent years in the region). It is especially important that wildlife not be harassed during winter periods, breeding seasons and early in the rearing process. Exploration should be limited as much as possible during these crucial periods.

During winter wildlife are always in a depleted condition. Unnecessary disturbance by man causes them to use up critical and limited energy reserves which, often times, results in mortality. In less severe cases, the fetus being carried by mammals may be aborted or absorbed by the animal, thus reducing reproductive success of a population.

During breeding seasons, disturbance by man can negatively affect the number of breeding territories for some species of wildlife. Disturbance can also interrupt courtship displays and preclude timely interactions between breeding animals. This could result in reduced reproductive success and ultimate reductions in population levels.

Early in the rearing process, young animals need the peace and tranquillity normally afforded by remote wildlands. It is also during this crucial period that young animals gain the strength and ability to elude man and other predators. This allows the young animal to develop in relatively unstressed situations and to utilize habitats that are secure from predators. Disturbance by man can compromise this situation and result in abandonment of the young by the female, increased accidents that result in mortality to young animals or increased natural predation.

It is recommended that employees be cautioned against disturbing young animals or females with young if accidentally located.

Employees associated with coal handling operations should be instructed that when wildlife are encountered during routine work that they not stop vehicles for viewing purposes. Moving traffic is less disturbing to wildlife than traffic that stops or results in out-of-the-vehicle activities. If viewing is desirable, the vehicle should only be slowed, but not stopped.

Hunting and other state and federal wildlife regulations must be adhered to by sportsmen utilizing the project area.

#### Mitigation and Impact Avoidance Procedures for Aquatic Wildlife

There are no recommendations for a wildlife plan that would enhance any perennial water or fishery since none are associated with the Company's proposed operation.

#### Mitigation and Impact Avoidance Procedures for Terrestrial Habitats

It is recommended that all habitats associated with dry washes be maintained. Roads and other facility developments should not destroy or degrade these limited and highly productive habitats. Roads crossing through those areas should do so in a manner that is least damaging to the habitat. Wetlands and riparian habitats associated with dry washes are of similar character to riparian habitats in other areas. They are ranked as being of critical value and are the most productive sites in terms of herbage and biota produced as compared to other local habitat types. It is probable that a majority of the vertebrate wildlife that inhabit the project area make some use of such sites.

It is important to note that roads and other surface facilities to be constructed should as far as practicable be placed at sites where they will not compromise wildlife or their use areas. Also, surface facilities, including roads, should be screened if possible from wildlife use areas by vegetation or terrain.

In situations where wildland habitats have been or will be disturbed, reclamation is required. Also, there are sites where development or enhancement of

wildland habitats through vegetation treatments and/or seedlings and transplants of seedlings could benefit wildlife. "Appendix B" depicts the Division's recommendation for plant materials to be utilized for various wildlife habitats on wildland treatments that are intended to benefit wildlife. If circumstances arise where seed or seedling transplants for a recommended plant species are not available, suitable alternates are also recommended.

Seedling transplants from nursery stock as well as nearby rangelands would also be acceptable for some wildland treatments.

Appendix C represents an exhaustive list of commercial sources for plant materials for use in wildland treatments.

Temporary control of rodents may be required to ensure a successful rangeland treatment. It is recommended that the county agent be consulted in this area of concern. Poisoned oats are the most common and acceptable method for rodent control; however, only licensed persons may apply the treatment.

Currently, there are some new concepts in methodology for revegetation that are being successfully implemented in other parts of the nation and world. One promising method is a procedure where a large scoop removes, from a natural and stabilized site, a small area of earth intact with vegetation and subsurface soils for placement on a site to be restored. This same procedure can be utilized when disturbing pristine sites, except that the native vegetation is stored for use in latent reclamation. Another meritorius method for stimulating natural revegetation, in combination with other reclamation techniques, is to plan facility developments so that islands of natural, native vegetation remain. This will allow for natural vegetation to spread from the islands. These techniques can also be useful for enhancement of poor quality sites that currently exist on the mine plan area.

Encapsulation of seed and fertilizer for several releases over a period of years after a single application is a new and possibly advantageous procedure. This technique along with soil stabilizing structures has been successfully used in South Africa. Dr. J. Van Wyk in the Department of Botany at Potchetstroom

University in South Africa could provide additional information on this new technique.

There are also new specialized techniques coming to the forefront for stabilization of problem sites such as roadbanks and steep slopes. It is important that these sites be promptly and permanently revegetated in order to reduce siltation into local riverine systems. This will mitigate for damage to aquatic wildlife populations and habitats from siltation. Enhancement of existing problem sites or reclamation of disturbed sites can mitigate for salt loading of local river systems. It is believed that natural, nonpoint sources represent 50 percent of the salinity in the upper basin of the Colorado River system into which this mine plan area drains.

It is recommended the Company make numerous contacts with appropriate agencies, institutions and persons to ensure that enhancement or reclamation projects achieve the required degree of permanency, plant diversity, extent of cover and capability of regeneration to ensure plant succession. Generally speaking, seeding should be accomplished as late in the fall as possible. Seedling transplants need to be coordinated with local soil moisture conditions which are usually at optimum in the early spring just as the snow melts.

It is paramount that suitable vegetation be maintained and/or re-established if the life requirements of wildlife are to be satisfied in the postmining period. Success in this area of concern along with cessation of man's disturbances will likely result in a natural reinvasion and the resultant inhabitation by most wildlife species of an impacted site.

It is important to note that enhancement or reclamation projects that are to benefit wildlife must be properly designed so that all the life requirements of the target species are considered in conjunction with forage. Water must be provided or be present and thermal cover along with escape and hiding cover has to be in abundance. Loafing areas and travelways between the many types of use areas must also be provided. In order to meet these goals, a considerable degree of consul-

tation will be required between the Company and Utah Division of Wildlife Resources.

As a service and also to ensure that the needs of wildlife are met, the various expertism within the Division of Wildlife Resources are available to the Company for consultation. For the most part, Larry Dalton, Resource Analyst, for the Southeastern Regional Office at 455 West Railroad Avenue in Price, Utah 84501 (phone 637-3310) will coordinate any needed contacts. Richard Stevens, Wildlife Biologist, at the Great Basin Research Center, Box 704, in Ephraim, Utah 84627 (phone 283-4441) is available for consultation and site specific analysis concerning species for vegetation plantings, timing and techniques to achieve the best results.

In instances where revegetation projects are to be planned over coal waste areas, heavy metal uptake by the plants must be evaluated. It is recommended that the Company initiate an appropriate long-term monitoring program to determine the magnitude and resolutions, if needed, for this problem.

It is recommended that persistent pesticides not be utilized on the project area. Other alternate pesticides or forms of control should be utilized.

All hazards associated with the project operation should be fenced or covered to preclude use by wildlife; of special concern would be sites having potential to entrap animals or toxic materials.

#### Mitigation and Impact Avoidance Procedures for Amphibians and Reptiles

Enhancement or development of habitats that provides a diversity of vegetation will benefit amphibians and reptiles. It is important to note that all of these species are protected by Utah law. Due to the myriad of myths that surround these animals, it is urged that individual specimens not be destroyed. This is especially true for snakes since they are a valuable component of the ecosystem.

Snake dens are ranked as being of critical value to the population and are protected by law. If a den is located, it should be reported to the Utah Division of Wildlife Resources. Snake dens can be moved, but only with intensive efforts that may take a year or more (snakes are caught and removed in the spring and fall).

Thus, construction of facility developments may take place in denning locations if there is sufficient lead time to relocate the occupants.

#### Mitigation and Impact Avoidance Procedures for Avifauna

It is recognizable that development and operation of a mining project will in some cases negatively impact many avian species through physical destruction of habitats and continual disturbance that makes other habitats unavailable or less desirable to an individual bird. It is also true that impacts that are negative to one species may be beneficial to another species. It is recommended that the Company plant native and/or ornamental berry producing shrubs around surface facilities. When mourning doves are a target species, sunflowers or blazing star should be planted. This will provide food and cover for many of the smaller species of birds, resulting in enhancement of their substantial value and high-priority habitats. This action would also mitigate for disturbances and destruction of avifauna habitats at other sites associated with project operations.

It is important to note that the nests of all avifauna (except the house sparrow, starling and ferral pigeon) when active and their eggs are protected by federal (Federal Migratory Bird Treaty Act) or state laws (Utah Code 23-17-1 and 23-17-2). All avifauna utilize a nest during their reproductive process. Dependent upon the species, some nests are well developed while others may be represented by only a scrape on the ground. These sites when being utilized are critical to maintenance of individual bird populations; each species has a specific crucial time period in which the nest is occupied. It is during this crucial period that the nest must be protected from disturbance.

Several species of raptors frequent the project area. Their nests when active should not be disturbed and abandoned stick nests are never to be damaged. Every effort should be made to eliminate man's disturbance within visual sight or one-half kilometer radius of an active raptor nest. This distance would have to be increased to a one-kilometer radius if the cause for disturbance were to originate within view and from above the nest. This effort is demanded in the instance of

golden eagles and cliff nesting falcons since they are sensitive to disturbance and could abandon the nest. Termination of man's use of a site would not be required if eagles or falcons constructed their nest after mining had been initiated, since it would demonstrate the individual bird's willingness to tolerate mining activities and the associated disturbance by man.

Roost trees for eagles, if located, must not be disturbed or destroyed. Similarly, activities planned for high-priority concentration areas of eagles must be designed and implemented so that they are not of significant disturbance to the birds.

As a general comment, whenever active raptor nests are observed or roost trees for eagles located, they need to be reported to the Utah Division of Wildlife Resources and the U.S. Fish and Wildlife Service.

Design and construction of all electrical power lines and other transmission facilities shall be designed in accordance with guidelines set forth in "Environmental Criteria for Electric Transmission System" published by the USDA and USDI in 1970 and/or the REA Bulletin 61-10 "Powerline Contacts by Eagles and Other Large Birds". It is also recommended that placement of utility poles over flat or rolling terrain be planned so that they are out of view of roads or at least 300 meters away from any roads. This will lessen opportunity for illegal killing of these valuable birds, since the poles can serve as suitable hunting perches for raptors. In some instances poles can result in an extension of raptor hunting territories, which would represent a beneficial impact.

During the crucial period of December through February spruce-fir forests and aspen forests need to be protected from man's disturbance so that blue grouse will not be impacted. Destruction of these wildlife habitats at any time of the year need be minimized due to their value to wildlife.

During the spring period (mid-March through mid-June) care needs to be taken that male blue grouse are not disturbed or precluded from establishing breeding territories.

Mature trees with natural cavities and dead snags need to be protected for use by cavity nesting birds. Trees with such a character are ranked as being of critical value to cavity nesting birds. The project should be planned so that three such trees are left standing per acre within 500 feet of forest openings and two such trees per acre in dense forested areas.

#### Mitigation and Impact Avoidance Procedures for Mammals

The lodges, nests and dens of all mammals or roosts in the instance of bat like mammals represent a critical use area for maintenance of their individual populations. The crucial period for any species is when the lodge, den, nest or roost is occupied. Therefore, such sites for any mammal must be protected from disturbance during that period when it is being utilized.

Many species of mammals develop food caches in order to carry individual animals or family groups through periods when they cannot forage. Such sites are of critical value to maintenance of their populations and if located should not be destroyed or subjected to regular disturbance by man.

It is important to realize that within natural ecosystems there exists a predator-prey relationship. One species of animal may represent a prey source for other species. Therefore, it is important that project operations be designed and implemented so as to not unnecessarily disturb or destroy any wildlife or their habitats.

Big game ungulates--mule deer and elk--each have seasonal use areas ranked as being of critical value to an individual herd. Such sites need to be protected from any of man's activities or developments that could result in destruction, loss or permanent occupancy of the site by man or has facility developments. If these types of impacts cannot be avoided the site must ultimately be reclaimed and re-vegetated. Also, critical valued areas need protection from disturbance during their appropriate crucial period.

High-priority valued use areas for all wildlife and particularly big game ungulates need to be protected from man's activities or facility developments.

Actions that would result in loss or permanent occupancy of significant acreages (25 or more acres) of habitat are of special concern. In any event impacts to high-priority valued areas should be limited and ultimate reclamation planned. Many impacts can be avoided simply by precluding exploration, developmental or other activities during the period of time when a high interest specie is present.

Haulage of coal between the various mine projects and distribution points should be planned so that impacts to wildlife are lessened; of special concern is haulage of coal through wintering areas for big game. It is recommended that the Company, when hauling coal with motor vehicles, develop coal haulage contracts that require personnel involved with coal haulage to use extreme caution so that accidental collisions between motor vehicles and big game are reduced. Without doubt, a reduction in speed across winter ranges would alleviate this problem during the period between November 1 and May 15 each year.

At present the most successful and cost effective technique for reducing deer-highway mortality is a system of warning reflectors. This system (manufactured by Strieter Corporation, 2100 Eighteenth Avenue, Rock Island, Illinois 61201 and known as "Swareflex") is only of value at night time, but it is during darkness that most deer-highway mortality occurs. Strieter Corporation describes the effect of the reflector system as follows: "The headlights of approaching vehicles strike the wildlife reflectors which are installed on both sides of the road. Unnoticeable to the driver, these reflect red lights into the adjoining terrain and an optical warning fence is produced. Any approaching wildlife is [are] alerted and stops or returns to the safety of the countryside. Immediately after the vehicle has passed, the reflectors become inactive, thereby permitting the animals to cross safely".

Installation of a wildlife warning reflector system, a reduction in speed of coal-haulage trucks and other mine related traffic and increased awareness of wildlife values by mine associated employees should result in a reduction of deer-highway mortality problems. Such a reduction would represent satisfactory miti-

gation.

In instances where conveyors, slurry lines or any other structure having potential to be a barrier to big game movement is to be developed, passage structures must be provided. Generally speaking overpass and underpass type structures are recommended in order to allow passage of big game to habitats either side of any barrier. These crossings should be placed at the points to be identified from intensive study of big game movements in relation to the mine plan area. Such study would not be required if the structure was adequately elevated to allow uninhibited passage of big game along its entire length.

Underpasses should have a minimum clearance of three meters maintained across a span of at least five meters. Overpasses should be designed as a circular earthen ramp with the barrier bisecting the ramp into two equal halves as follows:

On either side of the conveyor a half-round ramp with a slope no greater than 3:1 on a five meters wide path placed at an angle 90 degrees to the conveyor and tapering around to a slope of 5:1 at paths adjacent and parallel to the conveyor. The platform over the conveyor should be concrete or some other material that would not echo when being crossed by big game and should be of character similar to rock or natural earth.

Soils associated with either crossing style should be of the A or B horizons to allow for development of vegetation. Vegetative cover must be established in association with all crossing sites. This will lessen anxiety of individual animals using the site through development of a natural appearing environment.

Mature pinion or juniper trees and an abundance of browse plants need to be placed proximal to crossing points in order to provide a safe travelway. The browse plants will also serve as a permanent attraction for big game to crossing points. Additionally, a mixture of grass and forb seeds should be broadcast over each crossing point to stabilize the soil and enhance the forage situation.

Appropriately sized boulders may need to be placed at crossing sites in order to control off-road vehicles utilized in outdoor recreation.

Industrial developments are encouraged on habitat use areas that are ranked as being of limited value to wildlife. It should be noted, however, that reclamation is ultimately expected on any wildlife use area regardless of its value to

Table 1. Ranking of value per ecological association for wildlife habitats of vertebrate species having high interest to the state of Utah. Crucial-critical (C) habitats of the highest valued followed in respective order high-priority (H), substantial value (S) and limited valued (L) habitats.

Ecological Association	Wildlife Habitats											
	Riparian and Wetland	Desert Scrub	Pasture and Fields	Urban or Parks	Cliffs and Tallus	Sagebrush	P-J Forest	Shrubland	Aspen Forest	Ponderosa Forest	Parkland	Spruce-fir Forest
LOWER SONORAN LIFE ZONE												
Warm Desert	This ecological association does not exist in the Southeastern Region											
UPPER SONORAN LIFE ZONE												
Cold Desert C(H <sup>1</sup> , S <sup>2</sup> )	S	S	S	H								
TRANSITION LIFE ZONE												
Submontane C(H <sup>1</sup> , S <sup>2</sup> )	S	S	H	S		S	S					
CANADIAN LIFE ZONE												
Montane C(H <sup>1</sup> L <sup>2</sup> )	S	L	S					S	S	S	S	
HUDSONIAN LIFE ZONE												
Montane H(S <sup>1</sup> ; L <sup>2</sup> )				S								S
ALPINE LIFE ZONE												
Montane	This ecological association does not exist in the Southeastern Region											

This Table represents a summation of effort where by numerical values were assigned as a ranking per high interest specie to each wildlife habitat. The numerical values were as follows: critical, 1; high-priority, 2; substantial, 3; and limited, 4. Once the individual values were assigned they were then summed and a mean calculated, for each wildlife habitat. A mean value lying between 1.0 and 1.8 was ranked as critical; a value between 1.9 and 2.3 was ranked as high-priority; a value between 2.4 and 3.4 was ranked as substantial; and a value between 3.5 and 4.0 was ranked as limited.

1. Habitat ranking value for species associated with the riparian-wetland type that represents just the wet meadow situation.
2. Habitat ranking value for species associated with the riparian-wetland type that represents just the dirt bank situation.

In Utah. Crucial-critical (1), sections are the highest valued followed in respective order by high-priority (2), substantial value (3) and limited valued (4) sections.

BOOK CLIFFS

T.	R.	Section	Rank
12	8	1-36	1
12	9	2,4-12,14,16-18,31-35	1
		1,3,13,15,19-30,36	2
12	10	2-11,13-17,19-27	1
		1,12,18,28-36	2
12	11	16-28,33-35	1
		1-15,29-32,36	2
12	12	19,27-30,32-34	1
		1-18,20-26,31,35,36	2
13	8	1-3,5-16,19,20,22-24,28-31	1
		4,17,18,21,25-27,32-36	2
13	9	1-11,14,15,17,18,28,29,31-35	1
		12,13,16,19-27,30,36	2
13	10	1,2,6	1
		3-5,7-36	2
13	11	14-16,21-28,34-36	1
		1-13,17-20,29-33	2
13	12	4,19,30,31,36	1
		1-3,5-18,20-29,32-35	2
13	13	1-36	2
14	13	1-36	2
14	14	33	1
		1-32,34-36	2
15	14	1-21,23-26,28-36	2
		22,27	3
16	14	24-26,35,36	1
		1-23,27-34	2
16	15	3,10,11,14,23-25,29-33	1
		1,2,4-9,12,13,15-22,26-28,34-36	2
17	14	1,12,13,24,25,36	1
		2,3,10,11,14,15,22,23,26,27,34,35	2
17	15	4-9,16-22,27-34	1
		1-3,10-15,23-26,35,36	2
18	14	1,27	1
		2,3,10-15,22-26,34-36	2
18	15	4-10,15-18	1
		1-2,11-14,19,21-25,30-32	2
		3,20,26-29,33-36	3

HENRY MOUNTAINS

T.	R.	Section	Rank
27	9	1-36	1
30	9	25,32-36	3
		19-24,26-31	4
30	10	20-29,32-36	1
		19,30,31	3
31	8	1,7,12,13,18,19,24,25,30,31,36	3
		2-6,8-11,14-17,20-23,26-29,32-35	4
31	9	4-9,16-21,28-33	3
32	8	30,31	2
		1,5,7,10-15,18,20-29,33-36	3
		2-5,8,9,16,17,19,32	4
32	9	1,12,13,24,25,35,36	1
		2-11,14-23,26-34	3
33	8	6-8,12-14,17-20,22-36	2
		1-4,9-11,15,16	3
		5,21	4
33	9	1-3,9-17,20-28,34-36	1
		7,18,19,29-32	2
		4-6,8,33	3
34	8	1-3,10-13,15	2
		14	3
34	9	3	1
		2,5-11,13,14,16-19	2
		1,4,12,15,20-24,26-28	3
		25,29-36	4
34	10	1-23,26-30,32-34,36	2
		24,25,35	3
		31	4

KAIPAROWITS PLATEAU

T.	R.	Section	Rank
1		26,27,34-36	1
		25,33	2
		19-25,29-32	3
33	2	25,31-33	1
		19-21,29-30	3
34	1	1-3,10-14,24	1
		4-9,15-23,25-36	2
34	2	4-7,17,18,20,21,28,29	1
		8,9,16,19,30-33	2
35	2	3-10,15-19	1

KAIPAROWITS PLATEAU (CONTINUED)

T.	R.	Section	Rank
25	1	1-34	2
		35-36	3
35	2	4-9,16-20,25	2
		21-24,26-36	3
35	3	30-32	2
		19-29,33-36	3
36	3W	1-3,10-12,14,15	2
		13	4
36	2W	1-6,8-12	3
		7,13-18,22-27,34-36	4
36	1W	36	1
		1,24-26,35	2
		2-7,27-34	3
36	1	4-9,19-36	2
		1-3,10-18	3
36	2	30,31	2
		1-29,32-36	3
36	3	5,8,17,20,21,27,28,33-35	2
		1-4,6,7,9-16,18,19,22-26,29-32,35	3
37	1W	1,2,11-14,23-26,35,36	2
		3-10,15-22,27-34	3
37	1	1-36	2
37	2	6,7,12,13,17-20,24,25,29-32,36	2
		1-5,8-11,14-16,21-23,26-28,33-35	3
37	3	1,2,6-9,12,15-23,25-36	2
		3-5,10,11,13,14,24	3
37	4	20,21,28-33	2
		19	3
38	1W	1-3,11-14	2
		4-10,15-18	3
38	1	1-18,22-27,34-36	2
38	2	17	1
		1,4-9,12,13,16,18-21,24,25,28-33,36	2
		35	3
38	3	1-36	2
38	4	2-36	2
		1	4
38	5	19-22,26-36	2
		23-25	4
39	1	1-18,22-27,34-36	2
39	2	1,2,4-9,11-20,22-36	2
		3,10,21	3
39	3	1-36	2
39	4	1-36	2
39	5	1-36	2
40	2	1-36	2
40	3	1-36	2
40	4	1-36	2
40	5	1-36	2
40	6	4-9,16-21,28-33	2
41	2	1-30	2
		31-36	3
41	3	31-36	1
		1-21,29,30	2
		22-28	3
41	4	31-36	1
		1-17,20-28	2
		18,19,29,30	3
41	5	31-33	1
		1-9,11-14,18,23-26,35,36	2
		10,15-17,19-22,27-30,34	4
42	1W	13-36	1
		4,9	2
		1-3,5-8,10-12	4
42	3	1-36	1
42	4	1-36	1
42	5	2-36	1
		1	2
43	3	1-11,14-18	1
		12,13	4

WASATCH PLATEAU NORTH

T.	R.	Section	Rank
12	6	1-26,29,31,34-36	1
		27,28,30,32,33	2
12	7	1-15,17-36	1
		16	3
12	8	1-36	1
13	6	1,2,5-8,10,13,17-20	1
		3,4,9,11,12,14-16,21-36	2
13	7	1-4,9-17,19,22-26,31,32,35,36	1
		5-8,13,20,21,27-30,33,34	2

WASATCH PLATEAU NORTH (CONTINUED)

T.	R.	Section	Rank
14	6	28-33	1
		1-27,34-36	3
14	7	1,4-6,9,12,13,16	2
		2,3,7,8,10,11,14,15,17-36	3
15	6	4-6,10-15,22-24	2
		1-3,7-9,16-21,25-36	3
15	7	32-36	2
		1-31	4
15	8	9,15,20-22,27-29,32,33	3
		1-8,10-14,16-19,23-26,30,31,34-36	4
16	6	11,13,14,16,20-26,28,29,31-33,35,36	1
		1-10,12,15,17-19,27,30,34	2
16	7	1-5,9-16,21-28,34-36	2
		6-8,17-20,29-33	3
16	8	4,7,9,17-21,28-31	2
		1-3,5,6,8,10-16,22-27,32-36	3
17	6	4-9,11-14,16-22,24-35	2
		1-3,10,15,23,36	3
17	7	1,2,7,12,18,19,25,30	2
		3-6,8-11,13-17,20-24,26-29,31-36	3
17	8	5,6,16,19	2
		4,7-9,17,18,20,21,28-33	3
18	6	1-3,10,11,13-15,22-27,34-36	2
		12	3
18	7	4,5,7-11,13-17,19-27,29-32,34-36	2
		1-3,6,12,18,28,33	3
19	6	1-3,10-15,22-27,34-36	2
19	7	1-3,5,23,27-34	2
		4,24-26,35,36	3

WASATCH PLATEAU SOUTH

T.	R.	Section	Rank
20	5	20-29,31-36	2
		19,30	3
20	6	19-36	2
21	4	1-3,10-15,19-36	2
		4-9,16-18	4
21	5	1-36	2
21	6	4-9,16-21,28-33	4
22	3	1-3,10-15,22-27,34-36	2
22	4	1-4,9-16,21-28,33-36	2
		5-8,17-20,29-32	3
22	5	1-20,22-24,29-30	2
		21,25-28,31-36	3
23	3	1,12,13	2
		2,3,10,11,14,15,22-27	3
		34-36	4
23	4	2-4,6-11,14-18,20-29,31-36	2
		1,5,12,13,19,30	3
24	4	2,4-9,16-18	2
		1,3,10-15	3

This Table represents a summation of work published in 1977 as a "Ranking of Wildlife Values on Federal Coal Lands". Robert W. Scott performed the work as a Division of Wildlife Resources employee under contract (No. 14-16-006-3125) for the U.S. Fish and Wildlife Service. Scott's procedure ranked habitat use areas as critical, high-priority, substantial and limited value for selected individual species of high interest. After which the individual values were evaluated per legal section of land and a cumulative value was determined.

UMC 783.20; FISH AND WILDLIFE RESOURCE INFORMATION  
TOWER RESOURCES INC., CENTENIAL MINING PROJECT

General Wildlife Resource Information--All Species of Vertebrate Wildlife

The mine plan area encompasses a portion of the West Tavaputs Plateau in Carbon County, Utah. This area drains into Hayes Wash which is tributary of the Price River, which flows into the Green River and ultimately into the Colorado River at a point upstream from Lake Powell. Generally speaking, the West Tavaputs Plateau is encompassed by cold desert (upper Sonoran life zone), submontane (Transition life zone) and montane (Canadian life zone) ecological associations. These life zones could be inhabited on occasion and during different seasons of the year by about 364 species of vertebrate wildlife--20 fish species, 5 amphibian species, 15 reptile species, 244 bird species and 80 mammal species. It is interesting to note that 84 percent of these species are protected.

The mine plan area itself is represented by the Transition and Canadian life zones and provides habitat for approximately 184 species of wildlife--no fish species, 3 amphibian species, 15 reptile species, 106 bird species and 60 mammal species. Forty-seven of these species are of high interest to the State of Utah.

The Division Publication No. 78-16 "Species List of Vertebrate Wildlife that Inhabit Southeastern Utah" is appended (Appendix A) to this report since it represents a low level of study for the wildlife species listed. It identifies those species having potential to inhabit the region as well as those inhabiting the environs of the mine plan area. Appendix A also identifies which species are considered to be of high interest for the habitats and local area represented.

High interest wildlife are defined as all game species; any economically important species; and any species of special aesthetic, scientific or educational

significance. This definition would include all federally listed, threatened and endangered species of wildlife.

A ranking and display of wildlife habitats and use areas relative to high interest species of vertebrate wildlife has been developed (Table 1 and 2 and the attached map). Critical wildlife use areas followed in respective importance by high-priority, substantial value and limited value wildlife use areas require various levels of protection from man's activities and developments. Wildlife habitats and use areas ranked as being of critical or high-priority value to wildlife should be protected from surface disturbance, subsidence impacts and human or industrial disturbance. This can be accomplished through development and implementation of a wildlife plan.

For purposes of clarification the classification of waters in Utah that will be referenced in the following narrative represents a Division of Wildlife Resources system developed and applied to all of the State's waters in 1970. The classification system determined a numerical rating for each of the stream sections or lakes within Utah. (Insofar as possible, each stream section represents an ecologically and physically uniform stream segment.) The numerical values were developed through an evaluation at each water of esthetics, availability of the water to sportsmen and production of fish. Class 1 waters are the best and Class 6 are the poorest.

Critical wildlife use areas are "sensitive use areas" necessary to sustain the existence and perpetuation of one or more species of wildlife during crucial periods in their life cycles. These areas are restricted in area and lie within high-priority wildlife use areas. All stream sections, reservoirs, lakes and ponds identified by Utah Division of Wildlife Resources as Class 1 or 2 are classified as being critical. Biological intricacies dictate that significant disturbances cannot be tolerated by the members of an ecological assemblage on critical sites. Professional opinion is that disturbance to critical use areas or habitats will result in irreversible changes in species composition and/or

biological productivity of an area.

High-priority wildlife use areas are "intensive use areas" for one or more species of wildlife. "Intensive use areas" are not restricted in area and in conjunction with limited value use areas form the substantial value distribution for a wildlife species. All stream sections, reservoirs, lakes and ponds identified by Utah Division of Wildlife Resources as Class 3 are classified as being of high-priority. In addition, wildlife use areas where surface disturbance or underground activities may result in subsidence that could interrupt underground aquifers and result in a potential for local loss of ground water and decreased flows in seeps and springs should be considered as being of high-priority to wildlife.

Substantial value wildlife use areas are "existence areas" for one or more species of wildlife. "Existence areas" represent a herd or population distribution and are formed by the merging of high-priority and limited value wildlife use areas for a species. All stream sections, reservoirs, lakes and ponds identified by Utah Division of Wildlife Resources as Class 4 are classified as being of substantial value.

Limited value wildlife use areas are "occasional use areas" for one or more species of wildlife. "Occasional use areas" are part of the substantial value wildlife use area for a species. All stream sections, reservoirs, lakes and ponds identified by Utah Division of Wildlife Resources as Class 5 or 6 are classified as being of limited value.

## MAPPING

### Vegetation and Wildlife Habitats

It is recommended that the Company's primary effort be placed on identifying species of vegetation in each wildlife habitat within the various wildlife use areas for purposes of reclamation. The Division does not have site specific information relative to vegetation types at the mine plan area. However, there are

seven wildlife habitats present--riparian wetlands, cliffs and tallus, sagebrush, pinion-juniper forest, shrubland, ponderosa forest (limited to just scattered trees) and spruce-fir forest. The Company should identify each of these habitat associations on appropriately scaled maps.

It is believed that if satisfactory reclamation is achieved and man's disturbance does not continue or become a factor, that most species of wildlife displaced from the mine plan area will return. Without doubt, the key to success for enhancing or restoring wildlands will be development of habitats so that the postmining condition as compared to the premining condition will have similar species, frequency and distribution of permanent plants in each vegetative type. This will allow for natural plant succession. Additionally, other habitat features that represent the various life requirements for local wildlife must be provided.

#### Wildlife Use Areas

The enclosed map displays mapable, high value use areas for high interest wildlife on or adjacent to the mine plan area. This display includes stream sections and bodies of water, if any, utilized by high interest fish species. Also displayed are known seeps, springs, wetlands and riparian zones. Note that there are high interest wildlife distributions that are so broad that they cover the entire map and therefore are not illustrated. However, all vertebrate species of high interest wildlife and their distributions are discussed in the following narrative.

#### Water

Due to demands of state and federal coal mining regulations, the Company will probably be required to identify and appropriately monitor all surface waters for potential impacts from subsidence. This information should be correlated with the wildlife use area information due to the value of water to wildlife.

These unique habitat types must be identified in the permit application and protected due to their high value for all wildlife.

Quantitative (acreage) and qualitative (condition, successional stage and trend) data concerning the wildlife habitats in each ecological association should be included as part of the mine permit application. It is important to note that each legal section of land represented by the mine plan and adjacent areas has been ranked as to its value for the total wildlife resource. Sections 5, 6, 7, 8, 9, 12, 17 and 18 of Township 13 South Range 11 East have each been ranked as being of high-priority value to wildlife. These rankings were developed through an analysis of cumulative values for use areas of individual wildlife species inhabiting each legal section of land (Table 2).

#### Amphibians--Species Occurrence and Use Areas

Five species of amphibians, all of which are protected, are known to inhabit the biogeographic area in which the mine plan and adjacent areas are located. It is probable that three of these species inhabit the project area. Only one species of the amphibians inhabiting the project area has been determined to be of high interest to the State of Utah (Appendix A).

The tiger salamander is a yearlong resident animal that may inhabit the project area. The substantial value use area for the adult form is represented by any moist underground site or any similar habitat such as inside rotten logs, cellars or animal burrows. Such sites can be found within any wildlife habitat extending from the cold desert (upper Sonoran life zone) through the submontane (Transition life zone) and into the montane (Canadian life zone) ecological association. The larva form, often referred to as a mud-puppy, is a gilled animal that must remain in water within the above described ecological associations. It is interesting to note that the larva may fail to transform into an adult, even after their second season, and they can breed in the larva condition.

Once the larva is transformed into the adult form the animal is primarily terrestrial. Salamanders do migrate to water in the spring for breeding and

## FISH AND WILDLIFE INVENTORY

### Aquatic Use Areas

#### Macrophytes, Macroinvertebrates and Fish

No perennial streams are associated with the project, thus data relative to aquatic wildlife would not be practicable for presentation in the permit application.

It is important to note that no species of fish having relative abundances so low as to have caused them to be federally listed as threatened or endangered inhabit the mine plan or adjacent areas. The endangered humpback chub, bonytail chub and Colorado squawfish inhabit the Green and Colorado Rivers. Additionally, the humpback (razorback) sucker also inhabits those rivers; it is likely that this species will one day be federally listed as threatened. It is not believed that implementation and operation of the Company's project will impact any of these species.

### Terrestrial Use Areas

#### Wildlife Habitat Types

Of the seven wildlife habitat types present on the mine plan area wetlands and riparian habitats are ranked as being of critical value to all wildlife. These critical valued habitats are normally associated with drainage bottoms (ephemeral or intermittent), or perennial streams (UMC 700.5), seeps and springs within the upper Sonoran, Transition and Canadian life zones. Cliffs and their associated tallus areas that lie within the upper Sonoran or Transition life zones are ranked as being of high-priority value to all wildlife. When compared to all other wildlife habitats the aforementioned situations are considered to represent unique habitat associations (Table 1).

Riparian and wetland areas are highly productive in terms of herbage produced and use by wildlife as compared to surrounding areas. Experience has shown that as much as 70 percent of a local wildlife population are dependent upon riparian zones. Cliffs and tallus are of special importance to many high interest wildlife.

may remain there during much of the summer. Such an intensive use area would be ranked as being of high-priority value to the animal. In September the newly transformed animals leave the water to find suitable places to spend the winter.

The tiger salamander breeds from March through June and is sexually mature after one year. The male deposits a small tent-shaped structure containing a myriad of sperm on the pool bottom. During courtship the female picks up this structure in her cloaca; then the eggs are fertilized internally before or just at the time they are laid. The eggs, singly or in small clusters, adhere to submerged vegetation; after 10 to 12 days they hatch. Obviously, a critical period for maintenance of the population is when breeding salamanders, eggs or their larva are inhabiting a water.

Post-embryonic development of a salamander's larval form progresses at a pace somewhat controlled by water temperature; in some cold waters the larva may not transform into an adult and drying up of a pool may hasten the process.

Migration to or from water usually occurs at night, during or just after a rain storm. When inhabiting terrestrial sites the tiger salamander is most active at night, particularly on rainy nights, from March through September.

Larva, when small feed on aquatic invertebrates and become predacious to the point of cannibalism when they are larger. Food items for adults include insects, earthworms and occasionally small vertebrates.

No amphibians have relative abundances that are so low to have caused the animal to be federally listed as a threatened or endangered species.

#### Reptiles--Species Occurrence and Use Areas

Fifteen species of reptiles, all of which are protected, are known to inhabit the biogeographic area in which the mine plan and adjacent areas are located. It is probable that all of these species inhabit the project area.

Only one specie of the reptiles inhabiting the project area have been determined to be of high interest to the State of Utah (Appendix A).

The Utah milk snake is a yearlong resident animal of the project area. Its

substantial value use area encompasses all wildlife habitats extending from the upper Sonoran (cold desert life zone) through the submontane (Transition life zone) and into the montane (Canadian and possibly Hudsonian life zone) ecological associations. Although its use area spans a multitude of habitats, the animal is extremely secretive, mostly nocturnal and is often found inside or under rotten logs, stumps, boards, rocks or within other hiding places. At night they can be found in the open where they hunt for small rodents, lizards and other small snakes. Occasionally, the milk snake may take small birds or bird eggs.

The milk snake may live beyond twenty years and it becomes sexually mature during its third spring season. After mating, which occurs during spring or early summer when they are leaving the den, female milk snakes produce clutches which average seven eggs. The eggs are secreted in a moist warm environ and then abandoned; incubation lasts 65 to 85 days. The site where an individual snake has deposited its clutch of eggs is of critical value to maintenance of the species.

To date snake dens, which are protected and of critical value to snake populations, have not been identified on or adjacent to the project area. It is important to note that inventory for such has not been attempted. If the Company at some later time discovers a den it should be reported to the Utah Division of Wildlife Resources. If a den(s) is currently known, its location must be included with the permit application.

No reptiles have relative abundances that are so low to have caused the animal to be federally listed as a threatened or endangered species.

#### Birds--Species Occurrence and Use Areas

Two hundred forty-four species of birds, all of which are protected, are known to inhabit the biogeographic area in which the mine plan and adjacent areas are located. It is probable that one hundred six of these species inhabit the project area. Twenty-eight species of the birds inhabiting the project area

have been determined to be of high interest to the State of Utah (Appendix A).

The project and adjacent areas provides substantial valued habitat for a multitude of raptors--turkey vulture, bald and golden eagles, four species of falcons (prairie, American peregrine and arctic peregrine falcon and American kestrel), five species of hawks (goshawk, sharp-shinned, Cooper's, red-tailed and Swainson's hawks) and seven species of owls (barn, screech, flammulated, great horned, pygmy, long-eared and saw-whet owls). Many of these species are of high federal interest pursuant to 43 CFR, 3461.1 (n-1). All of these species are of high interest to the State of Utah (Appendix A).

Realistically, nesting habitat does not exist on the project or adjacent areas for most, if not all, of these species. However, if a species were to nest on or adjacent to the project area, it would have a specific crucial period during which the aerie would need protection from disturbance; this period of time lies between February 1 and August 15. Generally speaking, aerie represent a critical valued site and need protection from significant or continual disturbance within a one-half kilometer radius of the nest. This consideration need only be implemented during the period of time that the nest is occupied. Species specific protective stipulations for aeries are available from the Utah Division of Wildlife Resources and the U.S. Fish and Wildlife Service.

The current level of data relative to site specific use of the area by raptors is unsatisfactory. Likely, there are aeries that have not been identified. Many of these species are highly sensitive to man's disturbances. Therefore, it is recommended that intensive surveys be initiated on the mine plan and adjacent areas for determination of locations for raptor aerie territories. Such data needs to be merged with information provided within this report.

Golden eagles are a common yearlong resident of the mine plan area. To date no active aerie territories are known. (Note, an aerie territory is utilized by one pair of eagles but may contain several nest sites.) It is believed that aerie territories may exist on the project area. This belief is based upon

the fact that suitable nesting habitat is widespread on the mine plan area and throughout the local area.

An active golden eagle nest site is extremely sensitive to disturbance within a one-half kilometer radius. This buffer zone is ranked as being of critical value to maintenance of the eagle population when the bird is actually utilizing the aerie; that period of time is normally between April 15 and June 15. The radius for a buffer zone may need to be increased to one kilometer if a disturbance were to originate from above and within direct line of sight to the eagle aerie.

To date there are no known high-priority concentration areas or critical roost trees for golden eagles on the project area. The mine plan and adjacent areas have been ranked as being of substantial value to golden eagles.

The northern bald eagle is an endangered winter resident (November 15 to March 15) of the local area. To date there are no known high-priority concentration areas or critical roost trees for this species on or adjacent to the project. The mine plan area has been ranked as being of substantial value to wintering bald eagles. Note that no bald eagles are known to nest in Utah, however, historic data documents nesting activity by these birds in the State. There is no known historic evidence of the northern bald eagle nesting on the mine plan or adjacent areas.

The American peregrine falcon (status is endangered) and the prairie falcon (status is common) are yearlong residents of the mine plan and adjacent areas. Each of these species utilizes cliff nesting sites. To date there are no known aerie sites for cliff nesting falcons on the project area. However, suitable nesting habitat for the prairie falcon is widespread. Suitable nesting habitat for the American peregrine falcon cannot be found on the mine plan and adjacent areas. The project area has been ranked as being of substantial value to these two cliff nesting falcons.

For each falcon their aerie site while being utilized and a one-half kilo-

meter radius would be ranked as being of critical value to maintenance of their populations. The falcon's period of use at the aerie site spans the spring and early summer period--prairie falcon, April 15 to June 30; peregrine falcon, March 1 to June 30.

The level of data relative to site specific use of the project area by cliff nesting falcons (not including the kestrel) is unsatisfactory and there could be aeries that have not been identified. Therefore, it is recommended that intensive surveys be initiated on the area for determination of locations for cliff falcon aerie sites.

The endangered arctic peregrine falcon is a winter resident (November 15 through March 15) of the local area. This species has not been observed to utilize the environs on or adjacent to the mine plan area, however, its occasional presence would not be unlikely. Therefore, the project area is ranked as being of limited value to this species.

The blue grouse is a yearlong resident of the project area. Adult birds prefer open stands of conifers. During winter the blue grouse feeds exclusively upon needles and buds of douglas-fir and spruce trees. Thus, this wildlife habitat (spruce-fir forest) is ranked as being of critical value to over-winter survival of the population during the crucial period of December through February.

Blue grouse annually exhibit what has been termed a reverse vertical migration. That is, during the spring months, they migrate from the high elevation spruce-fir habitat to lower elevation sagebrush, pinion-juniper or shrubland habitats. This movement is caused by a need of the birds to feed on early developing vegetation. Such movement also facilitates successful breeding, nesting and brooding of their young. Then as the year progresses, they move to the higher elevations.

The males are polygamous and will set up and defend territories for booming and breeding activities against other breeding males. Such territories are critical to maintenance of the population during the crucial period of mid-March through mid-June.

After breeding the female develops a nest site which is secreted on the ground; the nest is of critical value to maintenance of the blue grouse population. Upon hatching, which occurs in late May and early June, the young accompanied by the hen immediately leave the nest. The young blue grouse while being brooded rely heavily on insects for their protein needs during the first several months of development. The adult bird also shifts its diet during this period to include a high proportion of insects. Brooding areas are ranked as being of high-priority value to blue grouse. The crucial period extends from hatching into mid-August.

As summer progresses into the fall season the grouse consumes large quantities of berries.

The chukar is a yearlong resident of the project area. It is important to note that they are an exotic species introduced from Asia during the 1950's. These birds prefer open rocky areas in the cold desert and submontane ecological associations. During summer chukars feed on grass shoots and insects, but during winter their diet is primarily seeds. Their substantial valued habitats are the cliff and talus type and the associated desert scrub or shrubland types.

The winter season is a crucial period (early December through mid-February) for chukars; the birds concentrate on selected areas. Winter range has been ranked as being of critical value to over-winter survival of the chukar populations. Disturbance on winter range must be avoided when chukars are present.

Chukars are monogamous; the pairs nest between early April and late May. Nest sites are critical to maintenance of the population during the crucial nesting period.

It is important to note that all sources of water within the substantial valued use area for chukars are critical to maintenance of their populations on a yearlong basis.

Mourning doves normally inhabit the project and adjacent areas, which represents a substantial valued use area for these birds, between May 1 and September

15 each year. They nest throughout most of this period and each pair produces two clutches. The pinion-juniper and riparian habitats are ranked as being of high-priority value for nesting. Locally, mourning doves show two peaks in on-nest activity--early July and early August. Successful nesting activities and any water sources are critical to maintenance of the mourning dove population.

The black swift is a summer resident of the West Tavaputs Plateau. The montane ecological association represents the swift's substantial valued use area. Normally, the bird is associated with a small flock that represents a colony. Black swifts are usually observed soaring as pairs and they feed upon flying insects. A colony's nests are scattered along precipitous terrain where the nest is often secreted behind a waterfall. Such a moist habitat is not known to exist on the project area. Cliff and talus wildlife habitats are ranked as being of high-priority value to the black swift. There is evidence that pair bonds are long lasting and that a nest may be utilized in successive years.

The pileated woodpecker is a species having high federal interest pursuant to 43 CFR 3461.1 (n-1). The spruce-fir and aspen wildlife habitats of the montane ecological association represent this birds substantial valued use area. It is important to note that the pileated woodpecker has never been documented to utilize the environs of the biogeographic area that surrounds the project site. In areas of the State where the bird is known to exist, it is a yearlong resident with a relative abundance considered to be rare.

The Williamson's sapsucker is another species having high federal interest pursuant to 43 CFR 3461.1 (n-1). Typically, the substantial valued use area for this species is the spruce-fir habitat of the Hudsonian life zone in the montane ecological association. Therefore, the spruce-fir habitat of the Canadian life zone on the project site would only represent the substantial valued use area for the yellow-bellied sapsucker. The yellow-bellied sapsucker is a yearlong resident of the environs associated with the project area and it has a relative abundance considered to be common. Where as the Williamson's sapsucker has never

been documented to utilize the environs of the biogeographic area that surrounds the project site. In areas of the State where the Williamson's sapsucker is known to exist, it is a summer resident with a relative abundance considered to be uncommon.

The Lewis woodpecker is also another species having high federal interest pursuant to 43 CFR 3461.1 (n-1). Its substantial valued use area is represented by riparian habitats characterized by cottonwood stands and ponderosa forests. These habitats do not exist on the project site. It is important to note that the Lewis woodpecker has never been documented to utilize the environs of the biogeographic area that surrounds the project site. In areas of the State where the bird is known to exist, it is a summer resident or only a transient. Its relative abundance is unknown.

The western bluebird is an uncommon summer resident known to inhabit the environs of the biogeographic area that surrounds the project site. Where as the mountain bluebird is a common yearlong resident of the area. Both birds are cavity nesting species. The western bluebird nests from the pinion-juniper habitat of the submontane ecological association up into the lower forest habitats within the Canadian life zone of the montane ecological association. The mountain bluebird utilizes the same continuum of habitats for nesting, but also extends its nesting use across the Canadian and Hudsonian life zones and into the Alpine life zone. During winter both species show elevational and longitudinal migrations; they then utilize all habitats associated with the cold desert ecological association. Therefore, the substantial valued use area for each species spans a broad continuum of habitats. It is important to note that trees with cavities located on the project area can be of critical value to bluebirds.

Grace's warbler is a species having high federal interest pursuant to 43 CFR 3461.1 (n-1). Its substantial valued use area is shrublands and associated ponderosa forest habitats of the submontane and montane ecological associations. This bird's nest is built twenty or more feet above ground in a ponderosa tree.

It is important to note that the Grace's warbler has never been documented to utilize the environs of the biogeographic area that surrounds the project site. In areas of the State where it is known to exist, it is a summer resident with a relative abundance considered to be uncommon.

Scott's oriole is also a species having high federal interest pursuant to 43 CFR 3461.1 (n-1). Its substantial valued use areas are riparian habitats characterized by cottonwood stands and the continuum of habitats extending from the pinion-juniper forest into shrublands of the submontane ecological association. The oriole's nest is characterized as a grassy pouch and is hung in a tree. It is important to note that the Scott's oriole has never been documented to utilize the environs of the biogeographic area that surrounds the project site. In areas of the State where it is known to exist, it is a summer resident with a relative abundance considered to be uncommon.

The grasshopper sparrow is a rare transient species known to inhabit the environs of the biogeographic area that surrounds the project site. It only frequents dry grassland areas in the desert scrub habitat of the cold desert ecological association during spring and fall migration periods; the project borders such areas. Since its use of such sites is best described as "occasional", those habitats in the region are only ranked as being of limited value to the bird.

#### Mammals--Species Occurrence and Use Areas

Eighty species of mammals, of which 22 percent are protected, are known to inhabit the biogeographic area in which the project and adjacent areas are located. It is probable that sixty of these species inhabit the project area. Seventeen species of the mammals inhabiting the project area have been determined to be of high interest to the State of Utah (Appendix A).

The dwarf (least) shrew is a yearlong inhabitant of the biogeographic area that surrounds the project site. This animal's substantial valued use area is characterized as open grass covered areas of any wildlife habitat in the submontane and montane (Canadian life zone) ecological associations. Since this

shrew has a relative abundance determined to be limited, its use areas should be ranked as being of high-priority value to the animal.

The red bat is a summer resident of the biogeographic area that surrounds the project site. The animal roosts in wooded areas (riparian woods and pinion-juniper forests) of the submontane ecological association. Such areas represent this animals substantial valued use area. An occasional individual has been known to utilize caves; those individuals could hibernate and remain over winter.

The western big-eared bat is a yearlong resident of the biogeographic area that surrounds the project site. This animal roosts and hibernates within caves, mine tunnels or suitable buildings located in the pinion-juniper, shrubland and low elevation spruce-fir habitats of the submontane and montane (Canadian life zone) ecological association. Such areas represent this bats substantial valued use area.

The cottontail rabbit (mountain cottontail inhabits sites lying between 7,000 and 9,000 feet in elevation and the desert cottontail inhabits sites lower than 7,000 feet in elevation) is a yearlong resident of the biogeographic area that surrounds the project site. The entire project area represents a substantial valued use area for cottontails. Their young are born between April and July. This is a crucial period for maintenance of the cottontail population.

The red fox and kit fox are yearlong inhabitants of the biogeographic area that surrounds the project site. The substantial valued use area for the red fox would include all wildlife habitats extending from the cold desert through the montane (Canadian life zone) ecological associations. The substantial valued use area for the kit fox is restricted to all of the habitats of the cold desert ecological association and extends into the sagebrush and pinion-juniper habitats of the submontane ecological association. Almost nothing is known of their population dynamics. Without doubt a crucial period for both species is when they are caring for young in the den. Dens while being inhabited are a critical use area.

The gray wolf is a historic inhabitant of the biogeographic area that surrounds the project site. Currently its relative abundance is so low that the animal is listed as endangered with extinction. The wolf's substantial valued use area would be represented by any remote habitat in any ecological association.

Black bears are inhabitants of the biogeographic area that surrounds the project site. Their substantial valued use area is represented by all natural wildlife habitats (excluding the pasture and fields and urban or park types) extending from the submontane into the montane (Canadian and Hudsonian life zones) ecological associations. These animals go into a semi-hibernation during winter. During this crucial period, which may last from December through March, the animal secrets itself in a den in order to conserve body energy reserves. The young are born in the den during January or February. Dens while being inhabited represent a critical valued use area for bears.

The wolverine and badger are the only members of the family mustelidae having potential to inhabit the biogeographic area that surrounds the project site. They are protected and classified as furbearers.

The substantial valued use area for wolverine is the montane ecological association. This specie may be found in the environs of the project site.

The substantial valued use area for badger spans all wildlife habitats other than dense forests in the cold desert, submontane and montane (Canadian life zone) ecological associations. They are dependent upon a suitable prey source.

A crucial period for maintenance of all furbearer populations is when they have young in a den. Such sites are critical for reproductive success.

Bobcat and cougar are known to inhabit the biogeographic area that surrounds the project site. For both of these species a crucial period for maintenance of their population is when the female has her young secreted at a den site. Such sites are of critical value when being utilized. It is also crucial to their survival that a female accompanied by young not be killed or harassed.

The substantial valued use area for bobcats extends from the cold desert through the submontane and into the montane (Canadian life zone) ecological association. The bobcat is normally associated with precipitous terrain, but has been observed in every wildlife habitat within the aforementioned ecological associations. Their primary prey source is represented by small mammals and birds or any other small animal they can catch. It is important to note that bobcats occasionally do kill the young of big game animals.

The substantial valued use area for the cougar (locally known as mountain lion) extends from the submontane into the montane (Canadian and Hudsonian life zone) ecological association. Due to the dependency of the cougar upon mule deer as a prey source, a ranking of the lion's seasonal distribution parallels that of the deer.

Mule deer are inhabitants of the biogeographic area that surrounds the project site. Their substantial valued use area spans all wildlife habitats extending from the cold desert through the submontane and montane ecological associations. In some situations deer show altitudinal migrations in response to winter conditions. There are, however, habitats where deer reside on a yearlong basis.

Migration of mule deer from summer range to winter range is initiated during late October; probably, the annual disturbance of the fall hunting season coupled with changing weather conditions is the initial stimulus. The onset of winter weather reinforces the deer's urge to migrate and continued adverse weather keeps the deer on the winter range.

The project site represents winter range for mule deer herd unit 27b. Winter ranges for mule deer are all ranked as being of high-priority value to the animal; these areas are usually inhabited between November 1 and May 15 each year. During winters with severe conditions the higher elevation portion of the winter range becomes unavailable to deer due to snow depth. Traditionally, some restricted portions of the winter range have shown concentrated use by the deer; these sites are ranked as being of critical value. Critical valued sites must be protected from man's disturbance when the deer are physically present on the

range (see attached map).

Deer begin their migration back to summer range during mid-May and remain there throughout October. There are no summer ranges on the project area.

Mule deer fawn during the month of June. The continuum of wildlife habitats extending from the pinion-juniper through the shrubland and into the aspen type probably represents the fawning area. All riparian areas are of critical value for fawning and maintenance of the deer population. To date no specific areas showing annual use for fawning are known. It is probable that such areas exist; they would be ranked as being of critical value to deer. It is important to note that June represents a crucial period for maintenance of deer populations.

Rocky mountain elk are inhabitants of the biogeographic area that surrounds the project site. Their substantial valued use area spans all wildlife habitats extending from the submontane through the montane ecological association. Elk do not show as strong of altitudinal migration as mule deer do in response to winter conditions, but they do migrate to wintering areas.

Migration of elk from summer range to winter range is initiated during late October; probably, the annual disturbance of the fall hunting seasons coupled with changing weather conditions is the initial stimulus. The onset of winter weather reinforces the elk's urge to migrate and continued adverse weather keeps elk on the winter range.

The project site represents winter range for the Avintiquin elk herd. Winter ranges for elk are ranked as being of either high-priority or limited value to the animal; these areas are usually inhabited between November 1 and May 15 each year (see attached map).

During winters with severe conditions some portions of the winter range becomes unavailable to elk due to snow depth. High-priority valued sites need to be protected from man's disturbance when the elk are physically present on the range.

Elk begin their migration back to summer range during mid-May and remain

there throughout October. There are no summer ranges for elk on the project area.

Elk calf during the month of June, but no animals would be expected to calf on the project area.

Currently, there are no other known high interest wildlife species or their habitat use areas on or adjacent to the project area. It is not unreasonable to suspect that in the future, some additional species of wildlife may become of high interest to the local area, Utah or the Nation. If such is the case, the required periodic updates of project permits and reclamation plans can be adjusted and appropriate recommendations made.

Appendix B

PERMITS, VIOLATIONS, INSURANCE & BOND

<u>Permit No. and Type</u>	<u>Permittee Name</u>	<u>Issuing Authority</u>	<u>Date of Issuance</u>	
854-0024	surface mining Tower Resources, Inc.	DSMRE Div. of Permits	1-9-84	→
854-0055	"	"	2-19-85	-
054-0073	" Cimarron Coal Corp.	"	4-24-82	
054-0139	"	"	6-16-82	
454-0139	"	"	5-26-84	
854-0039	"	"	4-13-84	
854-7000	"	"	11-26-84	
854-0023	"	"	9-13-84	
854-0091	"	"	6-12-86	
854-0051	"	"	2-11-85	
854-0094	"	"	4-16-86	
489-0026	" West Ken Coal Corp.	"	2-23-84	
889-0016	"	"	2-15-84	
889-0018	"	"	9-18-84	
654-0329	"	"	6-27-84	
875-0001	"	"	5-24-84	
889-0035	"	"	2-6-86	
489-9001	"	"	8-24-84	
889-9001	" AMCA Processing, Inc.	"	2-17-84	
889-9000	"	"	2-24-84	
089-9003	"	"	2-17-84	
889-8001	"	"	8-24-84	
UT/0022	" ANDALEX Resources, Inc. Office of Surface Mining		11-12-84	-
ACT/007/019	" State of Utah Division of Oil, Gas, and Mining			
#378	" Md. Bureau of Mines		1-4-82	-
#371	"		8-30-82	-
889-8001	" West Ken Coal Corp. DSMRE Div. of Permits		1-5-82	-
889-9000	"		10-06-86	
889-9001	"		9-29-86	
889-9001	"		9-29-86	
854-0023	" ANDALEX Resources, Inc. Cimarron Division		10-31-86	-
454-0139	"		10-08-86	
854-0039	"		10-09-86	
854-0051	"		10-06-86	
854-0088	"		10-10-86	
854-0091	"		9-29-86	
854-7000	"		10-06-86	
854-0094	"		12-01-86	
854-0024	" ANDALEX Resources, Inc.		9-29-86	-
854-0100	" ANDALEX RESOURCES, INC. Cimarron Division		1-6-87	-

PENDING PERMITS  
As of 1/23/87

			<u>Date Submitted:</u>	
854-9000	" ANDALEX Resources, Inc. Cimarron Division	"	11/11/86	-
889-0040	" West Ken Coal Corporation	"	12/10/86	

"ATTACHMENT 2.13.(c).A"

FOR ANY SURFACE MINING OPERATION OWNED OR CONTROLLED BY THE APPLICANT LIST EACH VIOLATION NOTICE AND NOTICE OF NON-COMPLIANCE RECEIVED DURING THE THREE (3) YEAR PERIOD PRIOR TO THIS APPLICATION, ISSUED PURSUANT TO PL 95-97, KRS CHAPTER 350 OR REGULATIONS PROMULGATED THERETO, AND ANY AIR OR WATER QUALITY VIOLATIONS ISSUED PURSUANT TO STATE AND FEDERAL LAW, RULE, OR REGULATION.

Date of Issuance 4-18-86 Issuing Regulatory Authority Kv. DSMRE  
Center Mine 2437-71  
Description of Violation Gullies formed on disturbed area; toxic material on spoil; inadequate sediment control; disturbed area not properly revegetated.

Actions Taken to Abate Violation Gullies filled, toxic material covered, sediment control made adequate, disturbed area vegetated.

Administration or Judicial Proceedings Initiated (Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location None

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_  
No Penalty

Date of Issuance 5/10/85 Issuing Regulatory Authority Kv. DSMRE  
West Ken Coal Corp., Center Mine, 875-0001  
Description of Violation Road creating large amount of dust during use.

Silt structure no. 4 beyond the clearout point of 50%.

Actions Taken to Abate Violation Haul road dressed up and silt structure no. 4 cleaned out.

Administration or Judicial Proceedings Initiated (Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location NONE

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_  
No Penalty

Date of Issuance \_\_\_\_\_ Issuing Regulatory Authority \_\_\_\_\_

Description of Violation \_\_\_\_\_

Actions Taken to Abate Violation \_\_\_\_\_

Administration or Judicial Proceedings Initiated (Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

"ATTACHMENT 2.15.(c).A"

FOR ANY SURFACE MINING OPERATION OWNED OR CONTROLLED BY THE APPLICANT LIST EACH VIOLATION NOTICE AND NOTICE OF NON-COMPLIANCE RECEIVED DURING THE THREE (3) YEAR PERIOD PRIOR TO THIS APPLICATION, ISSUED PURSUANT TO PL 95-97, KRS CHAPTER 350 OR REGULATIONS PROMULGATED THERETO, AND ANY AIR OR WATER QUALITY VIOLATIONS ISSUED PURSUANT TO STATE AND FEDERAL LAW, RULE, OR REGULATION.

Date of Issuance 11-22-85 Issuing Regulatory Authority Ky. DSMRE

AMCA Processing, Inc., 889-9001  
Description of Violation Failure of slurry discharge from processing

plant to discharge into underground disposal area.

Actions Taken to Abate Violation Keep slurry injection system open.

Administration or Judicial Proceedings Initiated (Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location NONE

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

\$1,000.00 Fine

Date of Issuance 2-6-86 Issuing Regulatory Authority Ky. DSMRE

Cimarron Coal Corp., 854-0039  
Description of Violation Exceeding peak particle velocity

Actions Taken to Abate Violation Check pounds of explosives and the delays  
more carefully.

Administration or Judicial Proceedings Initiated (Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

Date of Issuance 4-18-86 Issuing Regulatory Authority Ky. DSMRE

Center Mine 275-0028  
Description of Violation Permit markers not posted. Drainage not passing  
through silt structure. Material cleaned out of silt structures not properly  
disposed of. Small gullies over disturbed area

Actions Taken to Abate Violation Posted permit markers, drainage now passing  
through silt structures, gullies removed and area seeded, material from silt  
structures graded and seeded as per plan in approved permit

Administration or Judicial Proceedings Initiated (Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location NONE

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

No Penalty

"ATTACHMENT 2.13.(c).A"

FOR ANY SURFACE MINING OPERATION OWNED OR CONTROLLED BY THE APPLICANT LIST EACH VIOLATION NOTICE AND NOTICE OF NON-COMPLIANCE RECEIVED DURING THE THREE (3) YEAR PERIOD PRIOR TO THIS APPLICATION, ISSUED PURSUANT TO PL 95-87, KRS CHAPTER 350 OR REGULATIONS PROMULGATED THERETO, AND ANY AIR OR WATER QUALITY VIOLATIONS ISSUED PURSUANT TO STATE AND FEDERAL LAW, RULE, OR REGULATION.

Date of Issuance 2/13/84 Issuing Regulatory Authority Ky. DSMRE  
Center Mine, Permit No. 275-0028  
Description of Violation Discharge from sediment structure no. 4 not meeting effluent limitations

Actions Taken to Abate Violation Treated water

Administration or Judicial Proceedings Initiated (Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location NONE

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_  
\$500.00 Fine

Date of Issuance 4/2/84 Issuing Regulatory Authority Ky. DSMRE  
Cimarron Coal Corp., Permit No. 054-0046  
Description of Violation Substandard water left permit area, pH 5.41

Actions Taken to Abate Violation Treated water to meet standards

Administration or Judicial Proceedings Initiated (Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location NONE

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_  
\$460.00 Fine

Date of Issuance 12-20-84 Issuing Regulatory Authority Ky. DSMRE  
Cimarron Coal Corp., Permit No. 254-0304 & 854-0023  
Description of Violation violation of contemporaneous reclamation

Actions Taken to Abate Violation Permit revision submitted January 28, 1985 as per the Department's request in a letter January 18, 1985.

Administration or Judicial Proceedings Initiated (Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location NONE

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_  
No penalty

FOR ANY SURFACE MINING OPERATION OWNED OR CONTROLLED BY THE APPLICANT LIST EACH VIOLATION NOTICE AND NOTICE OF NON-COMPLIANCE RECEIVED DURING THE THREE (3) YEAR PERIOD PRIOR TO THIS APPLICATION, ISSUED PURSUANT TO PL 95-87, KRS CHAPTER 350 OR REGULATIONS PROMULGATED THERETO, AND ANY AIR OR WATER QUALITY VIOLATIONS ISSUED PURSUANT TO STATE AND FEDERAL LAW, RULE, OR REGULATION.

Date of Issuance 3/5/85 Issuing Regulatory Authority Ky. DSMRE  
Cimarron Coal Corp., Permit No. 854-0023  
Description of Violation violation of contemporaneous reclamation

Actions Taken to Abate Violation equipment placed on the permit  
and working on reclamation.

Administration or Judicial Proceedings Initiated (Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location NONE

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_  
No Fine

Date of Issuance 12-20-85 Issuing Regulatory Authority Ky. DSMRE  
Cimarron Coal Corp., Permit No. 854-0023  
Description of Violation violation of contemporaneous reclamation

Actions Taken to Abate Violation equipment placed on the permit  
and working on reclamation

Administration or Judicial Proceedings Initiated (Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location NONE

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_  
No Penalty

Date of Issuance 12-20-84 Issuing Regulatory Authority Ky. DSMRE  
Cimarron Coal Corp., Permit No. 254-0304  
Description of Violation violation of contemporaneous reclamation

Actions Taken to Abate Violation area revised under permit number  
854-0023

Administration or Judicial Proceedings Initiated (Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location NONE

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_  
No Penalty

FOR ANY SURFACE MINING OPERATION OWNED OR CONTROLLED BY THE APPLICANT LIST EACH VIOLATION NOTICE AND NOTICE OF NON-COMPLIANCE RECEIVED DURING THE THREE (3) YEAR PERIOD PRIOR TO THIS APPLICATION, ISSUED PURSUANT TO PL 95-87, KRS CHAPTER 350 OR REGULATIONS PROMULGATED THERETO, AND ANY AIR OR WATER QUALITY VIOLATIONS ISSUED PURSUANT TO STATE AND FEDERAL LAW, RULE, OR REGULATION.

Date of Issuance 4-17-84 Issuing Regulatory Authority Ky. DSMRE

DonBow Mine 854-0024.  
Description of Violation Operator removed excess material from access road and placed material in an area that would not pass through a sedimentation pond or a series of sedimentation ponds. Drainage goes into contributory of Lick Creek.

Actions Taken to Abate Violation Remove material to an area on permit that is covered by silt control.

Administration or Judicial Proceedings Initiated (Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

Date of Issuance 8-29-84 Issuing Regulatory Authority Ky. DSMRE

Cimarron 054-0108  
Description of Violation Sediment structure broke, sediment left structure.

Actions Taken to Abate Violation Sediment removed from diversion ditch and break repaired.

Administration or Judicial Proceedings Initiated (Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

No Penalty

Date of Issuance 8-24-84 Issuing Regulatory Authority Ky. DSMRE

DonBow 854-0024  
Description of Violation Levee broke

Actions Taken to Abate Violation Levee reconstructed and recertified

Administration or Judicial Proceedings Initiated (Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

No Penalty

FOR ANY SURFACE MINING OPERATION OWNED OR CONTROLLED BY THE APPLICANT LIST EACH VIOLATION NOTICE AND NOTICE OF NON-COMPLIANCE RECEIVED DURING THE THREE (3) YEAR PERIOD PRIOR TO THIS APPLICATION, ISSUED PURSUANT TO PL 95-87, KRS CHAPTER 350 OR REGULATIONS PROMULGATED THERETO, AND ANY AIR OR WATER QUALITY VIOLATIONS ISSUED PURSUANT TO STATE AND FEDERAL LAW, RULE, OR REGULATION.

Date of Issuance 6-19-85 Issuing Regulatory Authority Ky. DSMRE  
West Ken Coal Corp., Caney Creek Mine, 889-0016  
Description of Violation Failure to cause all drainage from the disturbed area to pass through a sedimentation pond before leaving the permitted area.

Actions Taken to Abate Violation The area has been graded and diverted in a manner to pass through a sedimentation structure no. 7.

Administration or Judicial Proceedings Initiated (Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_ NONE \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

No Penalty

Date of Issuance 7-15-85 Issuing Regulatory Authority Ky. DSMRE  
Cimarron Coal Corp., 454-0139  
Description of Violation Exceeding peak particle velocity.

Actions Taken to Abate Violation Cover holes and explosives more carefully

Administration or Judicial Proceedings Initiated (Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_ NONE \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

\$700.00 Fine

Date of Issuance 8-19-85 Issuing Regulatory Authority Ky. DSMRE  
Cimarron Coal Corp. 454-0139  
Description of Violation Exceeding peak particle velocity.

Actions Taken to Abate Violation Check poudages and delays more carefully.

Administration or Judicial Proceedings Initiated (Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_ NONE \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

No Penalty

FOR ANY SURFACE MINING OPERATION OWNED OR CONTROLLED BY THE APPLICANT LIST EACH VIOLATION NOTICE AND NOTICE OF NON-COMPLIANCE RECEIVED DURING THE THREE (3) YEAR PERIOD PRIOR TO THIS APPLICATION, ISSUED PURSUANT TO PL 95-87, KRS CHAPTER 350 OR REGULATIONS PROMULGATED THERETO, AND ANY AIR OR WATER QUALITY VIOLATIONS ISSUED PURSUANT TO STATE AND FEDERAL LAW, RULE, OR REGULATION.

Date of Issuance 5-23-84 Issuing Regulatory Authority Ky. DSMRE  
DonBow 054-0010  
Description of Violation Silt structure no. 8 breeched

Actions Taken to Abate Violation Silt structure no. 8 repaired

Administration or Judicial Proceedings Initiated (Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location NONE

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

\$500.00 Fine

Date of Issuance 4-3-84 Issuing Regulatory Authority Ky. DSMRE  
AMCA Processing 289-8005  
Description of Violation Discharge from silt structure no. 10 below

effluent standards

Actions Taken to Abate Violation Water was treated to meet effluent standards

Administration or Judicial Proceedings Initiated (Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location NONE

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

\$1,000.00 Fine

Date of Issuance 4-23-84 Issuing Regulatory Authority Ky. DSMRE  
Rhodes 489-0026  
Description of Violation Discharge from silt structure no. 2 below

effluent standards

Actions Taken to Abate Violation Water was treated to meet effluent standards

Administration or Judicial Proceedings Initiated (Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location NONE

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

No Penalty

"ATTACHMENT 2.13.(c).A"

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Date of Issuance 8-26-85 Issuing Regulatory Authority OSM  
DonBow 854-0024  
Description of Violation Failure to maintain stream channel diversion

Actions Taken to Abate Violation Stream channel diversion maintained  
Stabilized streambanks.

Administration or Judicial Proceedings Initiated (Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_ None \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_  
No Penalty

Date of Issuance 10-13-86 Issuing Regulatory Authority Ky. DSMRE  
Rhodes, 489-0026  
Description of Violation Failure to save all topsoil.

Actions Taken to Abate Violation Submit a revision to use alternate  
topsoil material.

Administration or Judicial Proceedings Initiated (Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_ None \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_  
\$1,800.00 Fine

Date of Issuance \_\_\_\_\_ Issuing Regulatory Authority \_\_\_\_\_

Description of Violation \_\_\_\_\_

Actions Taken to Abate Violation \_\_\_\_\_

Administration or Judicial Proceedings Initiated (Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

(1) (a) Name of permittee  
or applicant:

(6) Name of permit or application  
and permit or application number:

(c) Regulatory Authority

(1) (a) Name of permittee or applicant:	(6) Name of permit or application and permit or application number:	(c) Regulatory Authority
		Bureau of Surface Mining and Reclamation Enforcement Ky. Dept. for Natural Resources and Environmental Protection
Andalex Resources, Inc.	054-0009	Surface Disturbance Mining Permit
"	054-0010	"
"	054-0059	"
DonBow Mine	3721-74	"
"	6342-77	"
"	6695-77	"
Cimarron Coal Corp.	1169-67 thru 75	"
"	254-0062	"
"	254-0328	"
"	254-7000	"
"	254-0291	"
"	054-0073	"
"	054-0066	"
"	054-0046	"
"	254-0367	"
"	254-0297	"
"	254-0304	"
"	254-0362	"
Badgett Mine Stripping Corp.	407-72	"
"	2211-70	"
"	2211-71	"
"	289-0227	"
"	5418-76S#1	"
"	289-0355	"
"	289-0354	"
"	407-74R	"
"	407-72S#1	"
"	407-73	"
"	407-73-S#1	"
"	407-74S#1	"
"	407-73R	"
"	407-74R	"
"	5151-76R	"
"	254-0329	"

(1) (a) Name of permittee  
or applicant:

(6) Name of permit or application  
and permit or application number:

(c) Regulatory Authority

(1) (a) Name of permittee or applicant:	(6) Name of permit or application and permit or application number:	(c) Regulatory Authority
Badgett Mine Stripping Corp.	2237-72	Bureau of Surface Mining and Reclamation Enforcement Ky. Dept. for Natural Resources and Environmental Protection
"	2237-71	"
"	2437-71S#1	"
"	2437-71S#2	"
"	2437-71S#3	"
"	2437-74R	"
"	2437-70	"
West Ken Coal. Corp.	275-0028	"
"	089-0033	"
"	275-7000	"
"	289-0320	"
"	289-0354	"
"	289-0133	"
"	289-0226	"
"	092-0054	"
"	089-0026	"
AMCA Processing, Inc.	5778-76	State of Maryland
Andalex Resources, Inc.	251	Bureau of Mines
"	259	"
"	284	"

4.3 FOR ANY SURFACE MINING OPERATION OWNED OR CONTROLLED BY THE APPLICANT LIST EACH VIOLATION NOTICE AND NOTICE OF NON-COMPLIANCE RECEIVED DURING THE THREE (3) YEAR PERIOD TO THIS APPLICATION, ISSUED PURSUANT TO PL 95-87, KRS CHAPTER 350 OR REGULATIONS PROMULGATED THERETO, AND ANY AIR OR WATER QUALITY VIOLATIONS ISSUED PURSUANT TO STATE AND FEDERAL LAW, RULE, OR REGULATION.

Date of Issuance 9/18, 19, 23/80 Issuing Regulatory Authority OSM  
Permit No. 254-0291, Volunteer Mine  
Description of Violation Failure of discharge from disturbed area to meet state & federal effluent limitations. Failure to pass all surface drainage through a sedimentation pond.

Actions Taken to Abate Violation Repaired pumping hose to stop discharge from leaving the permit. All surface drainage is now passing through a sedimentation pond.

Administrative or Judicial Proceedings Initiated (Including proceedings initiated by applicant) NONE

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

\$1500.00 Fine reduced to \$800, Paid

-----  
Date of Issuance 9/18, 19, 23/80 Issuing Regulatory Authority OSM  
Permit No. 254-0291, Volunteer Mine

Description of Violation Disturbance outside the permitted area. Permittee has removed earthen fill material from a pit adjacent to Highway 1221 to facilitate the construction & operation of the haul road on permit 254-0291. Disturbed unpermitted area.

Actions Taken to Abate Violation Reclaimed the open pit adjacent to Highway 1221 to approximate original contour. Detour for the closed section of Highway 1221 has been constructed and the permit revision and deferment request have been submitted to the State R.A.

Administrative or Judicial Proceedings Initiated (Including proceedings initiated by applicant) NONE

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

\$1100.00 Fine reduced to "No Penalty"

-----  
Date of Issuance 8/13/81 Issuing Regulatory Authority Ky. BSMRE  
Permit No. Volunteer Mine

Description of Violation Water leaving the permit without going through a approved silt basin.

Actions Taken to Abate Violation Water passed through an approved silt basin.

Administrative or Judicial Proceedings Initiated (Including proceedings initiated by applicant) NONE

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

No Penalty

4.3 FOR ANY SURFACE MINING OPERATION OWNED OR CONTROLLED BY THE APPLICANT LIST EACH VIOLATION NOTICE AND NOTICE OF NON-COMPLIANCE RECEIVED DURING THE THREE (3) YEAR PERIOD TO THIS APPLICATION, ISSUED PURSUANT TO PL 95-87, KRS CHAPTER 350 OR REGULATIONS PROMULGATED THERETO, AND ANY AIR OR WATER QUALITY VIOLATIONS ISSUED PURSUANT TO STATE AND FEDERAL LAW, RULE, OR REGULATION.

Date of Issuance 10/04/79 Issuing Regulatory Authority Ky. BSMRE  
AMCA Processing, Inc.

Description of Violation Waste materials not demonstrated as suitable for use as fill material. Operating without a permit.

Actions Taken to Abate Violation Area engineer said gob need not be permitted.

Administrative or Judicial Proceedings Initiated(Including proceedings initiated by applicant) NONE

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

No Penalty

-----  
Date of Issuance 7/23/80 Issuing Regulatory Authority OSM

Permit #5778-76 AMCA Processing

Description of Violation Discharge from disturbed area in violation of water quality standards of pH 6 - 9 and Fe less than 7mg/l refers to silt basin on east side adjacent to access road.

Actions Taken to Abate Violation Treated water to meet water quality standards of pH 6 - 9 and Fe less than 7mg/l and 3.5 mg/l 30 day average.

Administrative or Judicial Proceedings Initiated(Including proceedings initiated by applicant) NONE

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

No Penalty

-----  
Date of Issuance 7/23/80 Issuing Regulatory Authority OSM

AMCA Processing

Description of Violation Discharge from disturbed area in violation of water quality standards.

Actions Taken to Abate Violation Water treated to compliance with water quality standards of pH 6 - 9 and Fe less than 3.5mg/l 30 day average.

Administrative or Judicial Proceedings Initiated(Including proceedings initiated by applicant) NONE

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

No Penalty

- 4.3 FOR ANY SURFACE MINING OPERATION OWNED OR CONTROLLED BY THE APPLICANT LIST EACH VIOLATION NOTICE AND NOTICE OF NON-COMPLIANCE RECEIVED DURING THE THREE (3) YEAR PERIOD TO THIS APPLICATION, ISSUED PURSUANT TO PL 95-87, KRS CHAPTER 350 OR REGULATIONS PROMULGATED THERETO, AND ANY AIR OR WATER QUALITY VIOLATIONS ISSUED PURSUANT TO STATE AND FEDERAL LAW, RULE, OR REGULATION.

Date of Issuance 2/17/81 Issuing Regulatory Authority Ky. BSMRE  
Permit No. 289-0354 West Ken Coal Corp., Caney Creek Mine  
Description of Violation Backfilling and grading not completed within

180 days of coal removal

Actions Taken to Abate Violation Area in question was reclaimed;  
backfilled, graded, topsoil spread, limed, seeded, and mulched.

Administrative or Judicial Proceedings Initiated(Including proceedings  
initiated by applicant) NONE

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

No Penalty

-----  
Date of Issuance 6/04/80 Issuing Regulatory Authority Ky. BSMRE  
Permit No. 289-0354 West Ken Coal Corp., Caney Creek Mine  
Description of Violation Failure to save all topsoil

Actions Taken to Abate Violation Supplement the topsoil by bringing  
good sub soil from permit no. 089-0033 for proper coverage.

Administrative or Judicial Proceedings Initiated(Including proceedings  
initiated by applicant) NONE

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

Settlement order dated Aug. 4, 1980 - No Penalty

-----  
Date of Issuance 5-16-83 Issuing Regulatory Authority KY DSMRE  
Cimarron 254-0291  
Description of Violation Embankment has breached

Actions Taken to Abate Violation Rebuild berm

Administrative or Judicial Proceedings Initiated(Including proceedings  
initiated by applicant)

Date 8-11-83 Location Madisonville

Type Preliminary

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

\$500.00 Fine

4.3 FOR ANY SURFACE MINING OPERATION OWNED OR CONTROLLED BY THE APPLICANT LIST EACH VIOLATION NOTICE AND NOTICE OF NON-COMPLIANCE RECEIVED DURING THE THREE (3) YEAR PERIOD TO THIS APPLICATION, ISSUED PURSUANT TO PL 95-87, KRS CHAPTER 350 OR REGULATIONS PROMULGATED THERETO, AND ANY AIR OR WATER QUALITY VIOLATIONS ISSUED PURSUANT TO STATE AND FEDERAL LAW, RULE, OR REGULATION.

Date of Issuance 4/21/82 Issuing Regulatory Authority OSM  
089-0033 Caney Creek Mine  
Description of Violation Failure to cause all surface drainage from disturbed area to pass through sedimentation structure before leaving the permit.

Actions Taken to Abate Violation The breached portion of the ditch was repaired by reberming with a tractor.

Administrative or Judicial Proceedings Initiated (Including proceedings initiated by applicant) NONE

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

No Penalty

-----  
Date of Issuance 7/16-17/80 Issuing Regulatory Authority OSM  
Permit #089-0033 Caney Creek Mine  
Description of Violation Failure to post permit identification signs.

Actions Taken to Abate Violation Permit identification signs were properly posted.

Administrative or Judicial Proceedings Initiated (Including proceedings initiated by applicant) NONE

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

No Penalty

-----  
Date of Issuance 7/16-17/80 Issuing Regulatory Authority OSM  
Permit #089-0033 Caney Creek Mine  
Description of Violation Failure to install ground water monitoring wells according to approved plans.

Actions Taken to Abate Violation Required ground water monitoring wells were properly installed.

Administrative or Judicial Proceedings Initiated (Including proceedings initiated by applicant) NONE

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

\$900.00 Fine Reduced - No Penalty

- 4.3 FOR ANY SURFACE MINING OPERATION OWNED OR CONTROLLED BY THE APPLICANT LIST EACH VIOLATION NOTICE AND NOTICE OF NON-COMPLIANCE RECEIVED DURING THE THREE (3) YEAR PERIOD TO THIS APPLICATION, ISSUED PURSUANT TO PL 95-87, KRS CHAPTER 350 OR REGULATIONS PROMULGATED THERETO, AND ANY AIR OR WATER QUALITY VIOLATIONS ISSUED PURSUANT TO STATE AND FEDERAL LAW, RULE, OR REGULATION.

Date of Issuance 7/17/80 Issuing Regulatory Authority OSM  
Permit No. 289-0354 West Ken Coal Corp., Caney Creek Mine  
Description of Violation Failure to post and maintain topsoil markers

applies to topsoil stockpiles located in central portion of the permit.

Actions Taken to Abate Violation Topsoil markers were placed on topsoil stockpiles located in central portion of the permit.

Administrative or Judicial Proceedings Initiated (Including proceedings initiated by applicant) NONE

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

No Penalty

-----  
Date of Issuance 7/24/80 Issuing Regulatory Authority OSM  
Permit No. 289-0133 West Ken Coal Corp., Caney Creek Mine  
Description of Violation Failure to implement approved ground water

monitoring program. Applies to failure to install approved ground water wells.

Actions Taken to Abate Violation N/A mining completed

Administrative or Judicial Proceedings Initiated (Including proceedings initiated by applicant) NONE

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

\$900.00 Fine - No Penalty (reduced)

-----  
Date of Issuance 7-26-83 Issuing Regulatory Authority KY DSMRE  
Center Mine 275-0028  
Description of Violation Substandard water discharged from silt

structures no. 1 and no. 2

Actions Taken to Abate Violation Monitor and treat silt structures

Administrative or Judicial Proceedings Initiated (Including proceedings initiated by applicant) NONE

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

\$600.00 Fine

4.3 FOR ANY SURFACE MINING OPERATION OWNED OR CONTROLLED BY THE APPLICANT LIST EACH VIOLATION NOTICE AND NOTICE OF NON-COMPLIANCE RECEIVED DURING THE THREE (3) YEAR PERIOD TO THIS APPLICATION, ISSUED PURSUANT TO PL 95-87, KRS CHAPTER 350 OR REGULATIONS PROMULGATED THERETO, AND ANY AIR OR WATER QUALITY VIOLATIONS ISSUED PURSUANT TO STATE AND FEDERAL LAW, RULE, OR REGULATION.

Date of Issuance 12/16/80 Issuing Regulatory Authority Ky. BSMRE  
Permit No. 089-0026 West Ken Coal Corp., Rhodes Mine  
Description of Violation No topsoil markers on topsoil stockpiles.

Spoil fell onto topsoil.

Actions Taken to Abate Violation Signs and markers were placed on topsoil stockpiles. Spoil was removed off topsoil.

Administrative or Judicial Proceedings Initiated (Including proceedings initiated by applicant) NONE

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

No Penalty

-----  
Date of Issuance 10-13-82 Issuing Regulatory Authority Ky. BSMRE  
Permit No. 254-0562 Cimarron Coal Corp., Volunteer Mine  
Description of Violation Material blasted off the permitted area into

Browder Church yard, north of Highway 70.

Actions Taken to Abate Violation Removed rocks that were blasted off of permit. Use additional cover over shots or mats to prevent material from flying off the permit.

Administrative or Judicial Proceedings Initiated (Including proceedings initiated by applicant) NONE

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

No Penalty

-----  
Date of Issuance 10-7-82 Issuing Regulatory Authority Ky. BSMRE  
Permit No. 054-0119 Cimarron Coal Corp., Volunteer Mine  
Description of Violation Sediment control measures, basin 11a, a dugout type structure is not functioning properly, (dugout has breached into diversion ditch).

Actions Taken to Abate Violation Riprapped spillway and recertified basin.

Administrative or Judicial Proceedings Initiated (Including proceedings initiated by applicant) NONE

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

No Penalty

4.3 FOR ANY SURFACE MINING OPERATION OWNED OR CONTROLLED BY THE APPLICANT LIST EACH VIOLATION NOTICE AND NOTICE OF NON-COMPLIANCE RECEIVED DURING THE THREE (3) YEAR PERIOD TO THIS APPLICATION, ISSUED PURSUANT TO PL 95-87, KRS CHAPTER 350 OR REGULATIONS PROMULGATED THERETO, AND ANY AIR OR WATER QUALITY VIOLATIONS ISSUED PURSUANT TO STATE AND FEDERAL LAW, RULE, OR REGULATION.

Date of Issuance 7/07/81 Issuing Regulatory Authority OSM

Permit #089-0026 Rhodes Mine

Description of Violation Failure of discharge from disturbed area

to meet effluent limitations of pH 6 - 9

Actions Taken to Abate Violation Basin discharges treated to pH 9

Administrative or Judicial Proceedings Initiated(Including proceedings initiated by applicant) NONE

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

No Penalty

-----  
Date of Issuance 6-8-83 Issuing Regulatory Authority KY DSMRE

Cimarron 054-0092

Description of Violation Dragline used to remove topsoil from prime

farmland area

Actions Taken to Abate Violation Use scrapers to remove topsoil

from prime farmland area

Administrative or Judicial Proceedings Initiated(Including proceedings initiated by applicant)

Date 8-11-83 Location Madisonville

Type Preliminary

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

\$1000.00 Fine

-----  
Date of Issuance \_\_\_\_\_ Issuing Regulatory Authority \_\_\_\_\_

Description of Violation \_\_\_\_\_

Actions Taken to Abate Violation \_\_\_\_\_

Administrative or Judicial Proceedings Initiated(Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

- 4.3 FOR ANY SURFACE MINING OPERATION OWNED OR CONTROLLED BY THE APPLICANT LIST EACH VIOLATION NOTICE AND NOTICE OF NON-COMPLIANCE RECEIVED DURING THE THREE (3) YEAR PERIOD TO THIS APPLICATION, ISSUED PURSUANT TO PL 95-87, KRS CHAPTER 350 OR REGULATIONS PROMULGATED THERETO, AND ANY AIR OR WATER QUALITY VIOLATIONS ISSUED PURSUANT TO STATE AND FEDERAL LAW, RULE, OR REGULATION.

Date of Issuance 11/04/81 Issuing Regulatory Authority Ky. BSMRE  
Permit No. 289-0227 Venture Mine  
Description of Violation Company has exhausted time limits on deferrals from backfilling and grading, pits deferred remain open, mine site remains inactive.

Actions Taken to Abate Violation Due to regulations change a waiver has been requested, action pending.

Administrative or Judicial Proceedings Initiated (Including proceedings initiated by applicant) NONE

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

Waiver granted 10-12-82

-----  
Date of Issuance 11/04/81 Issuing Regulatory Authority Ky. BSMRE  
Permit No. 289-0320 Venture Mine  
Description of Violation Company has exhausted time limits on deferrals from backfilling and grading, pits deferred remain open, mine site remains inactive.

Actions Taken to Abate Violation Due to regulation changes a waiver has been requested, action pending.

Administrative or Judicial Proceedings Initiated (Including proceedings initiated by applicant) NONE

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

Waiver granted 10-12-82

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Date of Issuance 4/02/81 Issuing Regulatory Authority OSM  
Permit No. 289-0320 Venture Mine  
Description of Violation Failure to provide current permit

identification numbers on permit sign.

Actions Taken to Abate Violation Current permit number has been posted on permit identification sign.

Administrative or Judicial Proceedings Initiated (Including proceedings initiated by applicant) NONE

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

\$700.00 Fine Reduced - No Penalty

4.3 FOR ANY SURFACE MINING OPERATION OWNED OR CONTROLLED BY THE APPLICANT LIST EACH VIOLATION NOTICE AND NOTICE OF NON-COMPLIANCE RECEIVED DURING THE THREE (3) YEAR PERIOD TO THIS APPLICATION, ISSUED PURSUANT TO PL 95-87, KRS CHAPTER 350 OR REGULATIONS PROMULGATED THERETO, AND ANY AIR OR WATER QUALITY VIOLATIONS ISSUED PURSUANT TO STATE AND FEDERAL LAW, RULE, OR REGULATION.

Date of Issuance 2/29/80 Issuing Regulatory Authority OSM  
Permit #289-0227 Venture Mine  
Description of Violation Failure to protect topsoil from wind and water erosion.

Actions Taken to Abate Violation Seeding and erosion control was established.

Administrative or Judicial Proceedings Initiated(Including proceedings initiated by applicant) NONE

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

No Penalty

-----  
Date of Issuance 2/29/80 Issuing Regulatory Authority OSM  
Permit #289-0320 Venture Mine  
Description of Violation Failure to conduct ground water monitoring according to approved plan.

Actions Taken to Abate Violation Sampling for underground monitoring conducted at wells designated 501, 502, & 505 by McCoy Water Consultants.

Administrative or Judicial Proceedings Initiated(Including proceedings initiated by applicant) NONE

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

\$360.00 Fine - Paid 8-8-80

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Date of Issuance \_\_\_\_\_ Issuing Regulatory Authority \_\_\_\_\_

Description of Violation \_\_\_\_\_

Actions Taken to Abate Violation \_\_\_\_\_

Administrative or Judicial Proceedings Initiated(Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

4.3 FOR ANY SURFACE MINING OPERATION OWNED OR CONTROLLED BY THE APPLICANT LIST EACH VIOLATION NOTICE AND NOTICE OF NON-COMPLIANCE RECEIVED DURING THE THREE (3) YEAR PERIOD TO THIS APPLICATION, ISSUED PURSUANT TO PL 95-87, KRS CHAPTER 350 OR REGULATIONS PROMULGATED THERETO, AND ANY AIR OR WATER QUALITY VIOLATIONS ISSUED PURSUANT TO STATE AND FEDERAL LAW, RULE, OR REGULATION.

Date of Issuance 6/08/80 Issuing Regulatory Authority Ky. BSMRE  
Permit No. 054-0010 DonBow Mine  
Description of Violation Mining within 300 ft. of an occupied dwelling  
without waiver from owner.

Actions Taken to Abate Violation Eliminated highwall by backfilling and grading, spreading topsoil, seeding, fertilizing and mulching the area within 300 ft. of a occupied dwelling.

Administrative or Judicial Proceedings Initiated(Including proceedings initiated by applicant) NONE

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

No Penalty

-----  
Date of Issuance 9/29/80 Issuing Regulatory Authority Ky. BSMRE  
Permit No. 054-0010 DonBow Mine  
Description of Violation Operator has failed to pass all surface drainage through a sedimentation pond or a series of sedimentation ponds.

Actions Taken to Abate Violation A sedimentation pond was constructed.

Administrative or Judicial Proceedings Initiated(Including proceedings initiated by applicant) NONR

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

No Penalty

-----  
Date of Issuance 6/12/80 Issuing Regulatory Authority Ky. BSMRE  
DonBow Mine  
Description of Violation All surface drainage not passing through a sedimentation pond.

Actions Taken to Abate Violation A sedimentation pond was constructed.

Administrative or Judicial Proceedings Initiated(Including proceedings initiated by applicant) NONE

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

No Penalty

4.3 FOR ANY SURFACE MINING OPERATION OWNED OR CONTROLLED BY THE APPLICANT LIST EACH VIOLATION NOTICE AND NOTICE OF NON-COMPLIANCE RECEIVED DURING THE THREE (3) YEAR PERIOD TO THIS APPLICATION, ISSUED PURSUANT TO PL 95-87, KRS CHAPTER 350 OR REGULATIONS PROMULGATED THERETO, AND ANY AIR OR WATER QUALITY VIOLATIONS ISSUED PURSUANT TO STATE AND FEDERAL LAW, RULE, OR REGULATION.

Date of Issuance 3/18/80 Issuing Regulatory Authority OSM  
Permit No. 054-0009 Tower Resources, Inc., DonBow Mine  
Description of Violation Failure to protect topsoil stockpiles.

Actions Taken to Abate Violation Stockpiles were seeded and mulched.

Administrative or Judicial Proceedings Initiated (Including proceedings initiated by applicant) NONE

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

No Penalty

Date of Issuance 4/29/81 Issuing Regulatory Authority Ky. BSMRE  
Permit No. 054-0059, Tower Resources, Inc., DonBow Mine  
Description of Violation Failed to maintain backfilling and grading at a current status. Failed to protect all stockpiled topsoil and failed to properly handle all topsoil removal.

Actions Taken to Abate Violation Brought backfilling and grading to a current status. Segregated and stockpiled all available topsoil and and protect and stabilize all stockpiles until they can be distributed. Place topsoil sign markers on stockpiles.

Administrative or Judicial Proceedings Initiated (Including proceedings initiated by applicant) NONE

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

\$250 Fine

Date of Issuance 3/08/82 Issuing Regulatory Authority OSM  
Permit No. 054-0059 Tower Resources, Inc., DonBow Mine  
Description of Violation Operator has caused disturbance beyond the permitted area as a result of not backfilling an inactive pit. Area above the highwall has sluffed causing damage to adjacent landowner's property outside the permitted area.

Actions Taken to Abate Violation Operator backfilled and regraded the spoil into the open pit adjacent to the northwest property line of Paul Love's property.

Administrative or Judicial Proceedings Initiated (Including proceedings initiated by applicant) None

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

No Penalty

4.3 FOR ANY SURFACE MINING OPERATION OWNED OR CONTROLLED BY THE APPLICANT LIST EACH VIOLATION NOTICE AND NOTICE OF NON-COMPLIANCE RECEIVED DURING THE THREE (3) YEAR PERIOD TO THIS APPLICATION, ISSUED PURSUANT TO PL 95-87, KRS CHAPTER 350 OR REGULATIONS PROMULGATED THERETO, AND ANY AIR OR WATER QUALITY VIOLATIONS ISSUED PURSUANT TO STATE AND FEDERAL LAW, RULE, OR REGULATION.

Date of Issuance 10/06/81 Issuing Regulatory Authority Ky. DNR Div. DonBow Mine  
Description of Violation Fugitive coal dust from portable Air Pol. Cont.

crusher

Actions Taken to Abate Violation The crusher was placed in storage and is no longer being used.

Administrative or Judicial Proceedings Initiated (Including proceedings initiated by applicant) NONE

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

No Penalty

-----  
Date of Issuance 10/16/81 Issuing Regulatory Authority Ky. BSMRE  
Permit # 054-0010 DonBow Mine  
Description of Violation Failed to reclaim an area of the permit located east of the haul road in a timely manner.

Actions Taken to Abate Violation Reclaimed area in question.

Administrative or Judicial Proceedings Initiated (Including proceedings initiated by applicant) NONE

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

No Penalty

-----  
Date of Issuance 1/04/82 Issuing Regulatory Authority Kv. BSMRE  
Permit # 054-0009 DonBow Mine  
Description of Violation Failed to pass all drainage from the permitted area through a sediment pond.

Actions Taken to Abate Violation All drainage is routed through a sediment pond.

Administrative or Judicial Proceedings Initiated (Including proceedings initiated by applicant) NONE

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

\$250.00 Fine

4.3 FOR ANY SURFACE MINING OPERATION OWNED OR CONTROLLED BY THE APPLICANT LIST EACH VIOLATION NOTICE AND NOTICE OF NON-COMPLIANCE RECEIVED DURING THE THREE (3) YEAR PERIOD TO THIS APPLICATION, ISSUED PURSUANT TO PL 95-87, KRS CHAPTER 350 OR REGULATIONS PROMULGATED THERETO, AND ANY AIR OR WATER QUALITY VIOLATIONS ISSUED PURSUANT TO STATE AND FEDERAL LAW, RULE, OR REGULATION.

Date of Issuance 12/17/80 Issuing Regulatory Authority OSM  
054-0059 DonBow Mine  
Description of Violation Failure to separately remove and stockpile  
the A & B horizons in those areas designated as prime farmland.  
Actions Taken to Abate Violation N/A

Administrative or Judicial Proceedings Initiated(Including proceedings initiated by applicant) NONE

Date \_\_\_\_\_ Location \_\_\_\_\_  
Type \_\_\_\_\_  
Current Status of Proceedings and of Violation Notice \_\_\_\_\_  
No Penalty

-----  
Date of Issuance 9/26,29,30/80 Issuing Regulatory Authority OSM  
Permit # 054-0010 DonBow Mine  
Description of Violation Failure to protect all topsoil stockpiles from  
wind and water erosion.

Actions Taken to Abate Violation Topsoil stockpiles located above the open  
pit were redistributed over reclaimed areas. The other stockpiles located  
along the northwest boundary have been graded down, seeded, and heavily  
mulched.

Administrative or Judicial Proceedings Initiated(Including proceedings initiated by applicant) NONE

Date \_\_\_\_\_ Location \_\_\_\_\_  
Type \_\_\_\_\_  
Current Status of Proceedings and of Violation Notice \_\_\_\_\_  
No Penalty

-----  
Date of Issuance 5/15/80 Issuing Regulatory Authority OSM  
Permit # 054-0059 DonBow Mine  
Description of Violation Failure to pass all surface drainage from the  
disturbed area through a sedimentation pond or series of sedimentation  
ponds before leaving permit area.

Actions Taken to Abate Violation Silt control has been established  
on the disturbrde area.

Administrative or Judicial Proceedings Initiated(Including proceedings initiated by applicant) NONE

Date \_\_\_\_\_ Location \_\_\_\_\_  
Type \_\_\_\_\_  
Current Status of Proceedings and of Violation Notice \_\_\_\_\_  
No Penalty

4.3 FOR ANY SURFACE MINING OPERATION OWNED OR CONTROLLED BY THE APPLICANT LIST EACH VIOLATION NOTICE AND NOTICE OF NON-COMPLIANCE RECEIVED DURING THE THREE (3) YEAR PERIOD TO THIS APPLICATION, ISSUED PURSUANT TO PL 95-87, KRS CHAPTER 350 OR REGULATIONS PROMULGATED THERETO, AND ANY AIR OR WATER QUALITY VIOLATIONS ISSUED PURSUANT TO STATE AND FEDERAL LAW, RULE, OR REGULATION.

Date of Issuance 6/18/80 Issuing Regulatory Authority Md. BOM  
Permit #251 RNC# 00504 Phillips Mine  
Description of Violation The number of open acres exceeds the approved  
open acre limit.

Actions Taken to Abate Violation INC. #00683, 00684

Administrative or Judicial Proceedings Initiated(Including proceedings initiated by applicant) NONE

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

-----  
Date of Issuance 7/02/80 Issuing Regulatory Authority Md. BOM  
Permit #251 RNC# 00514 Phillips Mine  
Description of Violation Spoil has been placed on area where the topsoil  
has not been removed. Sufficient topsoil is not being saved. Stockpiled  
topsoil has not been marked.  
Actions Taken to Abate Violation INC. #00636, 00637

Administrative or Judicial Proceedings Initiated(Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

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Date of Issuance 7/22/80 Issuing Regulatory Authority Md. BOM  
Permit #251 RNC# 00454 Phillips Mine  
Description of Violation Blasting had been conducted after the hours  
published publicly.

Actions Taken to Abate Violation INC. #00645

Administrative or Judicial Proceedings Initiated(Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

4.3 FOR ANY SURFACE MINING OPERATION OWNED OR CONTROLLED BY THE APPLICANT LIST EACH VIOLATION NOTICE AND NOTICE OF NON-COMPLIANCE RECEIVED DURING THE THREE (3) YEAR PERIOD TO THIS APPLICATION, ISSUED PURSUANT TO PL 95-87, KRS CHAPTER 350 OR REGULATIONS PROMULGATED THERETO, AND ANY AIR OR WATER QUALITY VIOLATIONS ISSUED PURSUANT TO STATE AND FEDERAL LAW, RULE, OR REGULATION.

Date of Issuance 9/17/80 Issuing Regulatory Authority Md. BOM  
Permit #251 RNC0 #00519 Phillips Mine  
Description of Violation Haulroad culverts were not adequate to control contribution drainage area. Diversions on backfill area have been extended too far, and drainage from backfill has caused severe problems at and above switchback on lower haulroad.  
Actions Taken to Abate Violation INC. #390

Administrative or Judicial Proceedings Initiated(Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_  
Type \_\_\_\_\_  
Current Status of Proceedings and of Violation Notice \_\_\_\_\_

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Date of Issuance 10/09/80 Issuing Regulatory Authority Md. BOM  
Permit #251 RNC0 #00541 Phillips Mine  
Description of Violation Diversion ditch has not been seeded and mulched. Topsoil stockpile has not been protected. Permit I.D. sign has not been displayed at point of access on Jackson Mountain Road.

Actions Taken to Abate Violation INC. #00393 Diversion ditch seeded & mulched, topsoil stockpile seeded and mulched, and permit identification sign has been installed at point of access on Jackson Mountain Road.

Administrative or Judicial Proceedings Initiated(Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_  
Type \_\_\_\_\_  
Current Status of Proceedings and of Violation Notice \_\_\_\_\_

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Date of Issuance 10/29/80 Issuing Regulatory Authority Md. BOM  
Permit #215 RNC0 #00464 Phillips Mine  
Description of Violation Topsoil on Area A was not being handled, removed, stockpiled and protected according to regulations and mining plan.

Actions Taken to Abate Violation INC. #00394 Topsoil on Area A is being stockpiled and protected.

Administrative or Judicial Proceedings Initiated(Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_  
Type \_\_\_\_\_  
Current Status of Proceedings and of Violation Notice \_\_\_\_\_

4.3 FOR ANY SURFACE MINING OPERATION OWNED OR CONTROLLED BY THE APPLICANT LIST EACH VIOLATION NOTICE AND NOTICE OF NON-COMPLIANCE RECEIVED DURING THE THREE (3) YEAR PERIOD TO THIS APPLICATION, ISSUED PURSUANT TO PL 95-87, KRS CHAPTER 350 OR REGULATIONS PROMULGATED THERETO, AND ANY AIR OR WATER QUALITY VIOLATIONS ISSUED PURSUANT TO STATE AND FEDERAL LAW, RULE, OR REGULATION.

Date of Issuance 6/04/80 Issuing Regulatory Authority Md. BOM  
Permit #259 RNC0 #00223 Phillips Mine  
Description of Violation Outslope control had not been installed as per approved plans.

Actions Taken to Abate Violation INC. #00326

Administrative or Judicial Proceedings Initiated(Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

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Date of Issuance 3/19/80 Issuing Regulatory Authority OSM  
NOV. #80-1-75-15 Permit #259 Phillips Mine  
Description of Violation Failure to meet effluent limitations for discharge from sediment pond.

Actions Taken to Abate Violation Treatment began immediately to meet state and federal regulations by using soda ash.

Administrative or Judicial Proceedings Initiated(Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

-----  
Date of Issuance 6/17/80-7/01/80 Issuing Regulatory Authority Md. BOM  
Permit #259 RNC0 00555, 00552 Phillips Mine  
Description of Violation Planting of backfilled area has not been completed. Pond located on south end of permit needs cleaned. Ponds and ditches for outslope control have not been imolented as per plans. Topsoil stockpile has not been protected.  
Actions Taken to Abate Violation INC. #00656, 00680

Administrative or Judicial Proceedings Initiated(Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

4.3 FOR ANY SURFACE MINING OPERATION OWNED OR CONTROLLED BY THE APPLICANT LIST EACH VIOLATION NOTICE AND NOTICE OF NON-COMPLIANCE RECEIVED DURING THE THREE (3) YEAR PERIOD TO THIS APPLICATION, ISSUED PURSUANT TO PL 95-87, KRS CHAPTER 350 OR REGULATIONS PROMULGATED THERETO, AND ANY AIR OR WATER QUALITY VIOLATIONS ISSUED PURSUANT TO STATE AND FEDERAL LAW, RULE, OR REGULATION.

Date of Issuance 3/27/80 Issuing Regulatory Authority Md. BOM

Permit No. 251 RNC0 #00438 Phillips Mine

Description of Violation Sediment control structures have not been

installed according to approved plan for total drainage control.

Actions Taken to Abate Violation INC. #00621, 00604, 00613

Administrative or Judicial Proceedings Initiated (Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

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Date of Issuance 4/01/80 Issuing Regulatory Authority Md. BOM

Permit No. 251 RNC0 #00471 Phillips Mine

Description of Violation Topsoil was not removed prior to placing spoil

on disturbed area.

Actions Taken to Abate Violation INC. #00602

Administrative or Judicial Proceedings Initiated (Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

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Date of Issuance \_\_\_\_\_ Issuing Regulatory Authority \_\_\_\_\_

Description of Violation \_\_\_\_\_

Actions Taken to Abate Violation \_\_\_\_\_

Administrative or Judicial Proceedings Initiated (Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

4.3 FOR ANY SURFACE MINING OPERATION OWNED OR CONTROLLED BY THE APPLICANT LIST EACH VIOLATION NOTICE AND NOTICE OF NON-COMPLIANCE RECEIVED DURING THE THREE (3) YEAR PERIOD TO THIS APPLICATION, ISSUED PURSUANT TO PL 95-87, KRS CHAPTER 350 OR REGULATIONS PROMULGATED THERETO, AND ANY AIR OR WATER QUALITY VIOLATIONS ISSUED PURSUANT TO STATE AND FEDERAL LAW, RULE, OR REGULATION.

Date of Issuance 11/03/80 Issuing Regulatory Authority Md. BOM  
Permit #259 RNC0 #00555 Phillips Mine  
Description of Violation Mining has taken place within 2 to 1 setback of transmission line and is in violation of approved plan. Total drainage control ditch has been removed temporarily. Diversions on backfilled and planted area have broken over. Drainage control ditch has broken over. Uncontrolled runoff on backfill and planted area has caused erosion.

Actions Taken to Abate Violation INC #00533 Pit backfilled & diversion TDC reconstructed.  
Administrative or Judicial Proceedings Initiated(Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

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Date of Issuance 7/21/80 Issuing Regulatory Authority OSM  
Permit #259 NOV. #80-1-15-25 Phillips Mine  
Description of Violation Total suspended solids discharge exceeded state and federal effluent limitations.

Actions Taken to Abate Violation Auxiliary catch basins were installed with straw bales placed at the outlets to retain sediment.

Administrative or Judicial Proceedings Initiated(Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

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Date of Issuance 6/18/80 Issuing Regulatory Authority Md. BOM  
Permit #284 RNC0 #00503 Phillips Mine  
Description of Violation Mining was to be resumed by 6/01/80 on this permit.

Actions Taken to Abate Violation INC. #00366, 00379

Administrative or Judicial Proceedings Initiated(Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

4.3 FOR ANY SURFACE MINING OPERATION OWNED OR CONTROLLED BY THE APPLICANT LIST EACH VIOLATION NOTICE AND NOTICE OF NON-COMPLIANCE RECEIVED DURING THE THREE (3) YEAR PERIOD TO THIS APPLICATION, ISSUED PURSUANT TO PL 95-87, KRS CHAPTER 350 OR REGULATIONS PROMULGATED THERETO, AND ANY AIR OR WATER QUALITY VIOLATIONS ISSUED PURSUANT TO STATE AND FEDERAL LAW, RULE, OR REGULATION.

Date of Issuance 10/13/80 Issuing Regulatory Authority Ma/ BOM  
Permit #284 RNC0 #00542 Phillips Mine  
Description of Violation No active mining of coal has taken place in last six months.

Actions Taken to Abate Violation INC. #00532

Operator satisfactorily completed backfilling.

Administrative or Judicial Proceedings Initiated(Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

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Date of Issuance 8/26/80 Issuing Regulatory Authority OSM  
Tipple NOV. #80-1-15-39 Phillips Mine  
Description of Violation No mine identification had been posted at entrance to tipple and shop area.

Actions Taken to Abate Violation Sign has been erected.

Administrative or Judicial Proceedings Initiated(Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

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Date of Issuance \_\_\_\_\_ Issuing Regulatory Authority \_\_\_\_\_

Description of Violation \_\_\_\_\_

Actions Taken to Abate Violation \_\_\_\_\_

Administrative or Judicial Proceedings Initiated(Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

4.3 FOR ANY SURFACE MINING OPERATION OWNED OR CONTROLLED BY THE APPLICANT LIST EACH VIOLATION NOTICE AND NOTICE OF NON-COMPLIANCE RECEIVED DURING THE THREE (3) YEAR PERIOD TO THIS APPLICATION, ISSUED PURSUANT TO PL 95-87, KRS CHAPTER 350 OR REGULATIONS PROMULGATED THEREFO, AND ANY AIR OR WATER QUALITY VIOLATIONS ISSUED PURSUANT TO STATE AND FEDERAL LAW, RULE, OR REGULATION.

Date of Issuance 10/3/80 Issuing Regulatory Authority Utah D.O.G.M.

Description of Violation Placing material on a downslope. Failure to pass surface drainage from the disturbed area through a sediment pond. Failure to protect topsoil.

Actions Taken to Abate Violation D.O.G.M. vacated material on downslope violation. All actions required by the D.O.G.M. to abate these violations were taken.

Administrative or Judicial Proceedings Initiated(Including proceedings initiated by applicant) NONE

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

No Penalty

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Date of Issuance 12/16/80 Issuing Regulatory Authority Utah D.O.G.M.

Description of Violation Failure to retain non-waste material.

failure to monitor groundwater.

Actions Taken to Abate Violation \_\_\_\_\_

Administrative or Judicial Proceedings Initiated(Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

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Date of Issuance \_\_\_\_\_ Issuing Regulatory Authority \_\_\_\_\_

Description of Violation \_\_\_\_\_

Actions Taken to Abate Violation \_\_\_\_\_

Administrative or Judicial Proceedings Initiated(Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

4.3 FOR ANY SURFACE MINING OPERATION OWNED OR CONTROLLED BY THE APPLICANT LIST EACH VIOLATION NOTICE AND NOTICE OF NON-COMPLIANCE RECEIVED DURING THE THREE (3) YEAR PERIOD TO THIS APPLICATION, ISSUED PURSUANT TO PL 95-87, KRS CHAPTER 350 OR REGULATIONS PROMULGATED THERETO, AND ANY AIR OR WATER QUALITY VIOLATIONS ISSUED PURSUANT TO STATE AND FEDERAL LAW, RULE, OR REGULATION.

Date of Issuance 3/13/81 Issuing Regulatory Authority Md. BOM  
Permit #251 Phillips Mine  
Description of Violation Haulroad, ditches, & culverts must be maintained. Road surface must be capped with a durable, non-toxic material. Backfilling & grading must be kept current.

Actions Taken to Abate Violation Haulroad, ditches, & culverts are being maintained. Road surface being capped with a durable, non-toxic material. Backfilling & grading being kept current.

Administrative or Judicial Proceedings Initiated (Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

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Date of Issuance 2/24/81 Issuing Regulatory Authority Md. BOM  
Permit #251 Phillips Mine  
Description of Violation Haulroads, culverts & ditches shall be maintained to minimize additional contributions of suspended soils to streamflow or off-site areas.

Actions Taken to Abate Violation Haulroads, ditches & culverts being maintained. Haulroad recapped with a durable, non-toxic material as soon as the weather permits.

Administrative or Judicial Proceedings Initiated (Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

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Date of Issuance 6/17/80 Issuing Regulatory Authority Md. BOM  
Permit #259 Phillips Mine  
Description of Violation Backfilled area not planted in a timely manner, pond needs cleaning, pond & ditches need to be constructed to provide outslope control, topsoil stockpile not been protected.

Actions Taken to Abate Violation Backfilled area was planted, pond cleaned out, pond & ditches were constructed, and topsoil stockpile was seeded and mulched.

Administrative or Judicial Proceedings Initiated (Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

4.3 FOR ANY SURFACE MINING OPERATION OWNED OR CONTROLLED BY THE APPLICANT LIST EACH VIOLATION NOTICE AND NOTICE OF NON-COMPLIANCE RECEIVED DURING THE THREE (3) YEAR PERIOD TO THIS APPLICATION, ISSUED PURSUANT TO PL 95-87, KRS CHAPTER 350 OR REGULATIONS PROMULGATED THERETO, AND ANY AIR OR WATER QUALITY VIOLATIONS ISSUED PURSUANT TO STATE AND FEDERAL LAW, RULE, OR REGULATION.

Date of Issuance 9/8/81 Issuing Regulatory Authority Md. BOM  
Permit #259 Phillips Mine  
Description of Violation Pond located on northwest side of permit has breached embankment.

Actions Taken to Abate Violation Operator has completed repair of embankment and implemented modifications to spillway as discussed.

Administrative or Judicial Proceedings Initiated (Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

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Date of Issuance 2/2/81 Issuing Regulatory Authority Md. BOM  
Permit #361 Phillips Mine

Description of Violation Topsoil markers not installed. Drainage from haulroad "B" not flowing towards ditch line. Turbidity & suspended solids in discharge from Waynesburg pump must meet effluent limitations. Backfilling equipment has been removed from the permit site.  
Actions Taken to Abate Violation Topsoil markers installed, haulroad "B" draining towards ditch line, backfilling equipment is back on the permit area.

Administrative or Judicial Proceedings Initiated (Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

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Date of Issuance 2/26/82 Issuing Regulatory Authority Md. BOM  
Permit #361 Phillips Mine  
Description of Violation Water discharging from pond "B" does not

Meet effluent limitations for pH.

Actions Taken to Abate Violation Discharge has been brought within effluent limitations.

Administrative or Judicial Proceedings Initiated (Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

- 4.3. FOR ANY SURFACE MINING OPERATION OWNED OR CONTROLLED BY THE APPLICANT LIST EACH VIOLATION NOTICE AND NOTICE OF NON-COMPLIANCE RECEIVED DURING THE THREE (3) YEAR PERIOD TO THIS APPLICATION, ISSUED PURSUANT TO PL 95-87, KRS CHAPTER 350 OR REGULATIONS PROMULGATED THERETO, AND ANY AIR OR WATER QUALITY VIOLATIONS ISSUED PURSUANT TO STATE AND FEDERAL LAW, RULE, OR REGULATION.

Date of Issuance 3/13/81 Issuing Regulatory Authority Md. BOM  
Permit # 361 Phillips Mine

Description of Violation Haulroad & ditches must be maintained and the road surface must be capped with a durable, non-toxic material.

Actions Taken to Abate Violation Haulroad & ditches are being maintained. The road has been capped with a durable, non-toxic material.

Administrative or Judicial Proceedings Initiated (Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

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Date of Issuance 5/12/81 Issuing Regulatory Authority Md. BOM  
Permit # 361 Phillips Mine

Description of Violation All backfilling equipment has been removed from the permit site.

Actions Taken to Abate Violation Backfilling equipment has been brought back to the permit site.

Administrative or Judicial Proceedings Initiated (Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

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Date of Issuance 5/25/81 Issuing Regulatory Authority Md. BOM  
Permit # 361 Phillips Mine

Description of Violation Ditches on haulroad "B" have not been maintained, burn holes on riser on pond "B" not being maintained, stockpiled topsoil not being protected, temporary access road has not been reseeded.

Actions Taken to Abate Violation Haulroad "B" ditches have been maintained, burn holes on riser on pond "B" have been maintained, temporary access road has been seeded, stockpiled topsoil has been seeded and mulched.

Administrative or Judicial Proceedings Initiated (Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

- 4.3 FOR ANY SURFACE MINING OPERATION OWNED OR CONTROLLED BY THE APPLICANT LIST EACH VIOLATION NOTICE AND NOTICE OF NON-COMPLIANCE RECEIVED DURING THE THREE (3) YEAR PERIOD TO THIS APPLICATION, ISSUED PURSUANT TO PL 95-87, KRS CHAPTER 350 OR REGULATIONS PROMULGATED THERETO, AND ANY AIR OR WATER QUALITY VIOLATIONS ISSUED PURSUANT TO STATE AND FEDERAL LAW, RULE, OR REGULATION.

Date of Issuance 6/16/81 Issuing Regulatory Authority Md. BOM  
Permit #361 Phillips Mine  
Description of Violation Discharge from pond "B" does not meet

effluent limitations for pH.

Actions Taken to Abate Violation Discharge from pond "B" treated to meet effluent limitations.

Administrative or Judicial Proceedings Initiated (Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

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Date of Issuance 3/18/82 Issuing Regulatory Authority Md. BOM

Permit #371 Phillips Mine  
Description of Violation Discharge from pond not meeting effluent limitations, pond bunker not being maintained, pond embankment not being maintained, diversion to pond has eroded, culvert needs sizing, Road not capped with a durable, non-toxic material.  
Actions Taken to Abate Violation Discharge treated to meet effluent limitations, pond bunker is maintained, pond embankment is maintained, Culvert was properly sized, road was capped with a durable, non-toxic material.

Administrative or Judicial Proceedings Initiated (Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

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Date of Issuance 12/14/80 Issuing Regulatory Authority Md. BOM

Permit #284 Phillips Mine  
Description of Violation Emergency spillway needs outlet cut back to original ground, trash rack needs implementing, entire area disturbed by pond construction needs seeding, topsoil not being saved.

Actions Taken to Abate Violation Emergency spillway was cut back, trash racks were implemented, disturbed area was seeded, and the topsoil is being properly saved and protected.

Administrative or Judicial Proceedings Initiated (Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

- 4.3 FOR ANY SURFACE MINING OPERATION OWNED OR CONTROLLED BY THE APPLICANT LIST EACH VIOLATION NOTICE AND NOTICE OF NON-COMPLIANCE RECEIVED DURING THE THREE (3) YEAR PERIOD TO THIS APPLICATION, ISSUED PURSUANT TO PL 95-87, KRS CHAPTER 350 OR REGULATIONS PROMULGATED THERETO, AND ANY AIR OR WATER QUALITY VIOLATIONS ISSUED PURSUANT TO STATE AND FEDERAL LAW, RULE, OR REGULATION.

Date of Issuance 11/17/81 Issuing Regulatory Authority Md. BOM  
Permit #284 Phillips Mine

Description of Violation Topsoil material on freeport pit is not being saved, segregated.

Actions Taken to Abate Violation Topsoil material is being saved and segregated.

Administrative or Judicial Proceedings Initiated (Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

Date of Issuance 7/21/81 Issuing Regulatory Authority Md. BOM  
Permit #284 Phillips Mine

Description of Violation Topsoil stockpiles adjacent to freeport area "B" have been covered with spoil material, not properly segregated.

Actions Taken to Abate Violation Topsoil stockpiles have been

~~segregated from spoil material.~~

Administrative or Judicial Proceedings Initiated (Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

Date of Issuance 6/9/81 Issuing Regulatory Authority Md. BOM  
Permit #284 Phillips Mine

Description of Violation Operator has not posted permit signs at points of access, haulroad not being maintained, pump not implemented at Bakerstown pit, diversion on east side of Freeport pit blocked, Topsoil not protected or identified.

Actions Taken to Abate Violation Blasting signs have been posted, haulroad is being maintained, pump implemented, diversion ditch cleared, topsoil stockpiled seeded, mulched, and identified.

Administrative or Judicial Proceedings Initiated (Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

4.3 FOR ANY SURFACE MINING OPERATION OWNED OR CONTROLLED BY THE APPLICANT LIST EACH VIOLATION NOTICE AND NOTICE OF NON-COMPLIANCE RECEIVED DURING THE THREE (3) YEAR PERIOD TO THIS APPLICATION, ISSUED PURSUANT TO PL 95-87, KRS CHAPTER 350 OR REGULATIONS PROMULGATED THERETO, AND ANY AIR OR WATER QUALITY VIOLATIONS ISSUED PURSUANT TO STATE AND FEDERAL LAW, RULE, OR REGULATION.

Date of Issuance 2/22/82 Issuing Regulatory Authority Md. BOM  
Permit #284 Phillips Mine  
Description of Violation Topsoil material is not being saved,

segregated, as per approved plan.

Actions Taken to Abate Violation Topsoil is being saved, protected,  
and identified.

Administrative or Judicial Proceedings Initiated (Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

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Date of Issuance 3/18/82 Issuing Regulatory Authority Md. BOM  
Permit #284 Phillips Mine  
Description of Violation Haulroad not being maintained adequately.

Actions Taken to Abate Violation Haulroad has been graded, crowned,  
capped with durable, non-toxic material, culvert inlets opened,  
haulroad ditches have been graded.

Administrative or Judicial Proceedings Initiated (Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_

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Date of Issuance \_\_\_\_\_ Issuing Regulatory Authority \_\_\_\_\_

Description of Violation \_\_\_\_\_

Actions Taken to Abate Violation \_\_\_\_\_

Administrative or Judicial Proceedings Initiated (Including proceedings initiated by applicant)

Date \_\_\_\_\_ Location \_\_\_\_\_

Type \_\_\_\_\_

Current Status of Proceedings and of Violation Notice \_\_\_\_\_