

AC 1/015/019-946

# **COTTONWOOD MINE**

CONTINGENT SEEDING AND PLANTING

<u>ITEM #</u>	<u>DESCRIPTION</u>	<u>EQUIPMENT</u>	<u>HOURS</u>	<u>LABOR</u>	<u>HOURS</u>	<u>TOTAL COST</u>	<u>CONST. DAYS</u>
12-A	Contingent Planting Materials	Flatbed Truck	8.5	1 Supervisor 3 Laborers	8.5	\$ 1,015.00	1.0
						<u>7,832.00</u>	
	TOTAL					\$ 8,847.00	

REVEGETATION INVENTORY FOR BOND RELEASE

13-A	Vegetation Inventory	None		1 Supervisor 2 Laborers	72.0	\$ 5,417.00	9.0
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SEDIMENT CONTROL - STRUCTURE REMOVAL

14-A	Wilberg Sediment Pond	D8	23.0	1 Operator	23.0	\$ 2,673.00	2.9
14-B	Cottonwood Ponds and Ditches	D8	8.0	1 Operator	8.0	930.00	1.0
		D6	8.0	1 Operator	8.0	617.00	1.0
		Loader	9.0	1 Operator 2 Laborers	9.0	453.00	1.1

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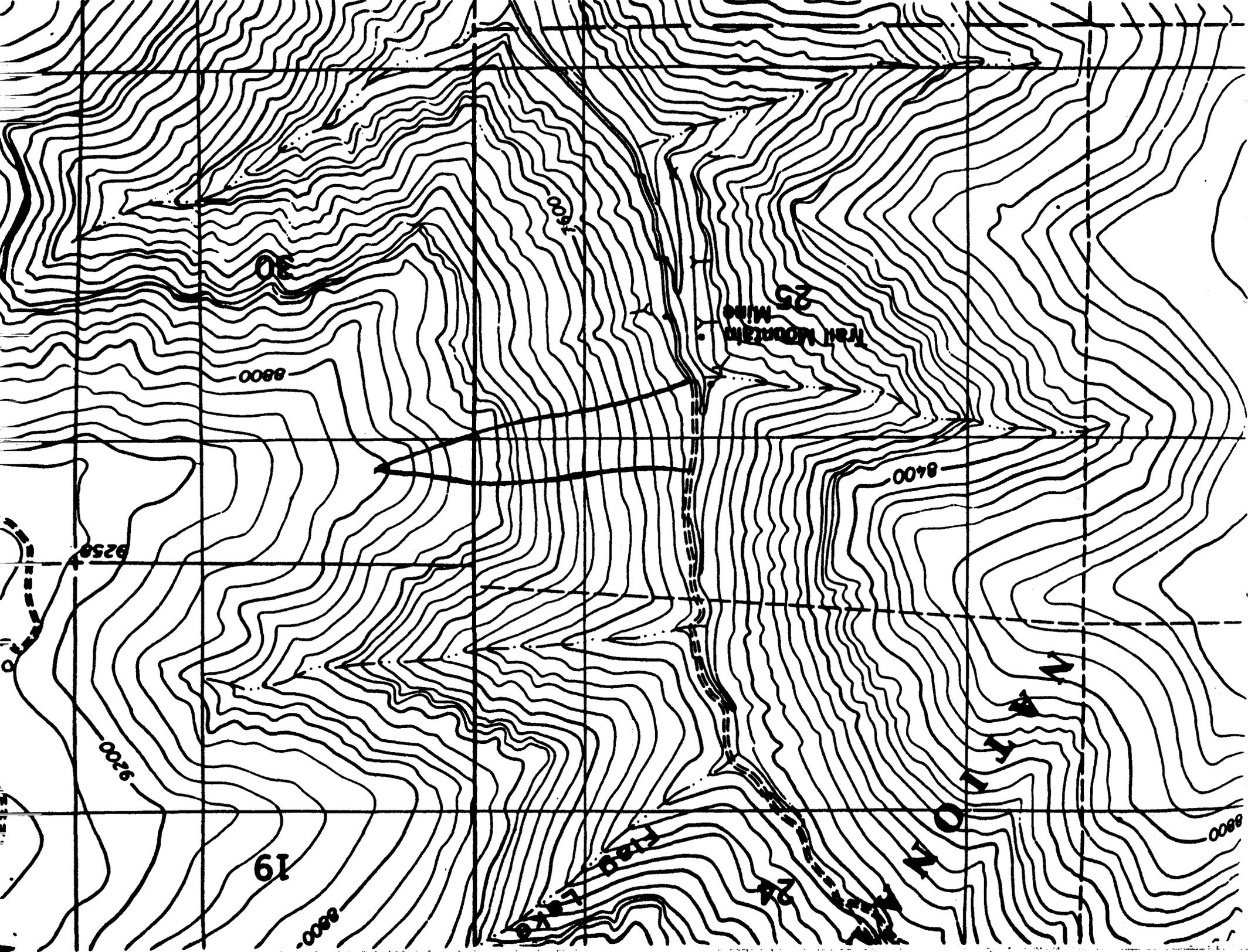
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15	Cottonwood	80 Ton Crane	12	Operators	173		
	Tube Conveyor,	25 Ton Crane	16	Laborers	202		
	Diesel Portal &	Utility Truck	36	Foreman	16		
	Conveyor Portal	Tractor/Flatbed	24				
		245 Hyd.	34				
		Excavator					
		10 yd Dump	48				
		Truck					
		D3 Dozer	30				
		Track Loader	14				
						<u>\$22,846.00</u>	
	Mobilization Construction Cost					\$ 10,000.00	
	+ 10% Contingency				105,831.00		
	+ 4.3% Reclamation Management					<u>45,407.00</u>	
	<b>TOTAL CONSTRUCTION COST</b>						
							<b>(1989 Dollars)</b>
	<b>\$1,209,646.00</b>						
	<b>ESCALATED FOR 10 YEARS AT 2.01% (1999 DOLLARS)</b>					<b>\$1,475,997.00</b>	

Revised 7/14/94

## APPENDICES

- I - **Coal Lithologic Logs**
  - a. Drill Hole EM-23C
  - b. Drill Hole EM-12C
  - c. Drill Hole A-25
  - d. Drill Hole B-124
- II - **Field Data For the Vegetation Reference Areas**
- III - **Cottonwood/Trail Mountain Overland Tube Conveyor Reclamation Cross-Sections, Vegetation and Soils of the Cottonwood/Trail Mountain Portal Area and Culvert Size Calculations**
- IV - **Cottonwood/Wilberg Facility Final Reclamation Earthwork Quantities, Cross-Sections and Stability Analysis**
- V - **Report of Engineering Geology Study (Dames & Moore)**
- VI - **Overburden Analysis**
- VII - **Underground Development Waste Plan**
- VIII - **Drainage Systems**  
Dwgs. 7704-C70A, C71A, C81A, C89A and C90A
- IX - **Road Plans and Cross-Sections**  
Dwgs. 7704-C50 thru C64
- X - **Road Construction Variance**
- XI - **Geotechnical Study - Stacking Tube**
- XII - **Blasting Plan**
- XIII - **Hydrologic Analysis of Disturbed Area Runoff Control Cottonwood/Wilberg Mine Portal Site and**  
**Hydrologic Analysis of Undisturbed and Disturbed Area Runoff Control Cottonwood Canyon Fan Portal Site.**  
(Hansen, Allen & Luce, Inc.)
- XIV - **Photographs of Existing Structures**
- XV - **Hydrologic Procedures and Calculations with Drainage Map CM-10379-EM Final Reclamation.**
- XVI - **Subsidence Monitoring Plan**
- XVII - **Safety Factor Calculations for Road and Impoundment Embankments**
- XVIII - **Stability Report - Cottonwood Fan Portal**
- XIX - **Hydrological Calculations - Cottonwood Fan Portal**
- XX - **UP&L Mining Division, Mine Permit Hydrologic Section (See Volume 9)**
- XXI - **Waste Rock Storage Facility (See Volume 10)**





Circular Channel Analysis & Design  
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: TRAIL 18"

Comment: TRAIL MTN. 18" CULVERT UNDER DIESEL ROAD

Solve For Actual Depth

Given Input Data:

Diameter.....	1.50 ft
Slope.....	0.1000 ft/ft
Manning's n.....	0.020
Discharge.....	2.47 cfs

Computed Results:

Depth.....	0.34 ft
Velocity.....	8.13 fps
Flow Area.....	0.30 sf
Critical Depth....	0.60 ft
Critical Slope....	0.0119 ft/ft
Percent Full.....	22.84 %
Full Capacity.....	21.59 cfs
QMAX @.94D.....	23.23 cfs
Froude Number.....	2.91 (flow is Supercritical)

**Project Title = TRAIL MTN. 18" RUNOFF (TOTAL)**

**WATERSHED HYDROGRAPH**

Inflow into structure # 1  
 Structure type: Null

-- Watershed data for watershed # 1

Curve number = 72.0  
 Area = 27.4 acres  
 Hydraulic length = 1900.00 Feet  
 Elevation change = 1440.0 feet.  
 Concentration time = 0.24 hours  
 Concentration time type = SCS Upland Curves  
 Unit hydrograph type = Forested

-- Watershed data for watershed # 2

Curve number = 95.0  
 Area = 0.1 acres  
 Hydraulic length = 410.00 Feet  
 Elevation change = 1.0 feet.  
 Concentration time = 0.11 hours  
 Concentration time type = SCS Upland Curves  
 Unit hydrograph type = Disturbed

-- Total Area = 27.5 acres

-- Storm data

Total precipitation = 2.2 inches  
 Storm type = SCS 6 hour design storm  
 Peak Discharge = 2.47 cfs  
 Discharge volume = 0.88 acre ft

time (hr.)	rainfall (in.)	hydrograph (cfs)	*	time (hr.)	rainfall (in.)	hydrograph (cfs)
0.00	0.000	0.000	*	0.20	0.028	0.000
0.40	0.028	0.000	*	0.60	0.035	0.000
0.80	0.042	0.001	*	1.00	0.042	0.003
1.20	0.047	0.006	*	1.40	0.047	0.009
1.60	0.065	0.015	*	1.80	0.084	0.023
2.00	0.084	0.027	*	2.20	0.327	0.127
2.40	0.327	0.971	*	2.60	0.208	2.018
2.80	0.088	2.336	*	3.00	0.088	2.470
3.20	0.070	2.383	*	3.40	0.070	2.374
3.60	0.059	2.418	*	3.80	0.048	2.372
4.00	0.048	2.364	*	4.20	0.043	2.337
4.40	0.043	2.347	*	4.60	0.039	2.345
4.80	0.035	2.307	*	5.00	0.035	2.284
5.20	0.032	2.236	*	5.40	0.032	2.203
5.60	0.033	2.204	*	5.80	0.035	2.231
6.00	0.035	2.259	*	6.20	0.000	1.854
6.40	0.000	1.433	*	6.60	0.000	1.104
6.80	0.000	0.883	*	7.00	0.000	0.774
7.20	0.000	0.675	*	7.40	0.000	0.584
7.60	0.000	0.501	*	7.80	0.000	0.426
8.00	0.000	0.359	*	8.20	0.000	0.298

time (hr.)	rainfall (in.)	hydrograph (cfs)		time (hr.)	rainfall (in.)	hydrograph (cfs)
8.20	0.000	0.298		8.60	0.000	0.194
8.40	0.000	0.243	*	9.00	0.000	0.114
8.80	0.000	0.151	*	9.40	0.000	0.056
9.20	0.000	0.082	*	9.80	0.000	0.017
9.60	0.000	0.034	*	10.20	0.000	0.000
10.00	0.000	0.006	*			
10.40	0.000	0.000	*			

Inflow into structure # 1  
 Structure type: Null

O. S. VII.

STORM PROGRAM

100 YR. 6HR.  
 EVENT

-- Watershed data for watershed # 1  
 Curve number = 95.0  
 Area = 0.1 acres  
 Hydraulic length = 45.00 Feet  
 Elevation change = 0.5 feet.  
 Concentration time = 0.01 hours  
 Concentration time type = SCS Upland Curves  
 Unit hydrograph type = Disturbed

FAD AREA = .028 ACRES  
 SMALL VALUE ACCEPTABLE  
 IN PROGRAM

-- Total Area = 0.1 acres ←

--- Storm data  
 Total precipitation = 2.2 inches  
 Storm type = SCS 6 hour design storm  
 Peak Discharge = 0.07 cfs  
 Discharge volume = 0.01 acre ft

time (hr.)	rainfall (in.)	hydrograph (cfs)	*	time (hr.)	rainfall (in.)	hydrograph (cfs)
0.00	0.000	0.000	*	0.10	0.014	0.000
0.20	0.014	0.000	*	0.30	0.014	0.000
0.40	0.014	0.000	*	0.50	0.014	0.000
0.60	0.021	0.000	*	0.70	0.021	0.000
0.80	0.021	0.001	*	0.90	0.021	0.001
1.00	0.021	0.002	*	1.10	0.023	0.003
1.20	0.023	0.004	*	1.30	0.023	0.004
1.40	0.023	0.005	*	1.50	0.023	0.005
1.60	0.042	0.010	*	1.70	0.042	0.011
1.80	0.042	0.012	*	1.90	0.042	0.013
2.00	0.042	0.014	*	2.10	0.164	0.054
2.20	0.164	0.066	*	2.30	0.164	0.070
2.40	0.164	0.073	*	2.50	0.164	0.075
2.60	0.044	0.028	*	2.70	0.044	0.021
2.80	0.044	0.021	*	2.90	0.044	0.021
3.00	0.044	0.021	*	3.10	0.035	0.017
3.20	0.035	0.017	*	3.30	0.035	0.017
3.40	0.035	0.017	*	3.50	0.035	0.017
3.60	0.024	0.012	*	3.70	0.024	0.012
3.80	0.024	0.012	*	3.90	0.024	0.012
4.00	0.024	0.012	*	4.10	0.022	0.011
4.20	0.022	0.010	*	4.30	0.022	0.010
4.40	0.022	0.010	*	4.50	0.022	0.010
4.60	0.018	0.009	*	4.70	0.018	0.009
4.80	0.018	0.009	*	4.90	0.018	0.009
5.00	0.018	0.009	*	5.10	0.016	0.008
5.20	0.016	0.008	*	5.30	0.016	0.008
5.40	0.016	0.008	*	5.50	0.016	0.008
5.60	0.018	0.008	*	5.70	0.018	0.009
5.80	0.018	0.009	*	5.90	0.018	0.009
6.00	0.018	0.009	*	6.10	0.000	0.001

COTTONWOOD OVERLAND TUBE CONVEYOR

APPENDIX III

CONVEYOR PAD (6") CMP

Circular Channel Analysis & Design  
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: TRAIL TUBE PAD

Comment:

Solve For Actual Depth

Given Input Data:

Diameter.....	0.50 ft
Slope.....	0.5700 ft/ft
Manning's n.....	0.020
Discharge.....	2.20 cfs

Computed Results:

Depth.....	0.34 ft
Velocity.....	15.58 fps
Flow Area.....	0.14 sf
Critical Depth....	0.50 ft
Critical Slope....	0.3486 ft/ft
Percent Full.....	67.59 %
Full Capacity.....	2.75 cfs
QMAX @.94D.....	2.96 cfs
Froude Number.....	5.00 (flow is Supercritical)

6" C.M.P. would  
BE .34 ft. full  
@ PEAK

### MILLER CANYON INTAKE PORTALS

The Miller Canyon intake portals were developed in October of 1981. This facility consists of three (3) portals ( 8 ft. x 20 ft.) on 100 ft. centers. The portals were used for intake purposes until the Wilberg Mine fire in December 1984. At that time they were temporarily sealed. The portals were subsequently sealed permanently in 1987.

The seal in the east portal is provided with a water monitoring pipe. Intermittent small quantity discharges occur at this point. The discharges are monitored in accordance with stipulations of NPDES UT-0022896-04.

### COTTONWOOD CANYON DIESEL AND TUBE CONVEYOR PORTALS

The Cottonwood Canyon diesel and tube conveyor portals were developed in 1994-1995. The portals are used for underground travel and conveyance of coal from the Trail Mountain Mine to the Cottonwood Mine surface facilities. (See Appendix III for reclamation cross-sections, soil, vegetation reports and culvert size calculations.) Reclamation of this area will use the same seed mixture listed in Part 4 of this plan. *Which one in part 4?*

### COTTONWOOD FAN PORTAL

In addition to the intake breakouts in Channel Canyon, which

is immediately south of Miller Canyon, a return breakout from the Hiawatha Seam may be necessary in Cottonwood Canyon.

No coal will be produced through the Cottonwood Canyon return portal. This portal site will be used solely to accommodate a mine fan and its ancillary equipment.

Mining studies have shown that increase ventilation capacity may be required in the Cottonwood Mine due to the increasing size of the mine and the requirements for more

## Conveyors

The coal handling circuit includes eight conveyors identified as follows:

- (2) Mine Belt Conveyors
  - Silo Feed Conveyor
  - Breaker Feed Conveyor
  - Recirculating Conveyor
  - Collecting Conveyor
  - Truck Load-out Conveyor
  - Cottonwood Canyon Tube Conveyor

All facility conveyors are 48" wide with the exception of the collecting conveyors, Cottonwood ROM conveyor, and Cottonwood Canyon Tube Conveyor which are 54", 60" and 60" wide respectively. All conveyors are covered to prevent wind erosion of their respective loads.

The Wilberg Mine belt conveyor delivers 16" x 0" coal from the mine to the coal transfer structure at maximum rate of 2,450 tph.

The Wilberg Mine silo feed conveyor collects 16" x 0" coal from the coal transfer and delivers up to 2,450 tph to the coal storage silo or emergency silo bypass. This conveyor is inclined at 7° and is 700 feet long.

In addition, the Cottonwood ROM belt conveyor delivers 16" x 0" coal to the coal silo at a maximum rate of 3800 tph.

The breaker feed conveyor delivers 16" x 0" coal from the reciprocating feeders under the silo to the breaker station feed box. It delivers on the average of 1,200 tph and may deliver as much as 1,500

## RECLAMATION COST

### RECLAMATION COST SUMMARY

<u>ITEM</u>	<u>ACTIVITY</u>	<u>CONSTRUCTION DAYS</u>	<u>COST</u>
1A-1Q	Surface Facilities Removal	106	399,692
2A,2B	Portal Sealing	74	77,736
3A-3L	Backfill and Grading	77.7	264,824
4A,5A	Rip-Rap Drainage Channels	12.5	70,974
6A,6B	Temporary Sedimentation Control Facility	4	3,169
7A-7D	Soil Sampling & Seedbed Preparation	27	17,608
8A-8D	Fertilizing and Mulching	45	38,504
9A-9D	Seeding and Planting	33	115,697
10A-10D	Plant Monitoring Disease & Pest Control	56	14,868
11A	Soil Stabilization - Rills and Gullies	4	3,453
12A	Contingent Seeding and Planting	1	8,847
13A	Revegetation Inventory - Bond Release	9	5,417
14A,14B	Sediment Control - Structure Removal	3,9	4,673
15	Cottonwood Canyon Tube Conveyor, Diesel Diesel Portal & Conveyor Portal		<u>22,846</u>
	SUBTOTAL		1,048,308
	MOBILIZATION		10,000
	+10% CONTINGENCY		<u>105,831</u>
	SUBTOTAL		1,164,139
	+4.3% RECLAMATION MANAGEMENT		<u>50,058</u>
	TOTAL		1,214,197

**BOND AMOUNT**

Reclamation cost total is \$1,214,197 (1989 Dollars). The Means Historical

Cost Index are as follows;

<u>YEAR</u>	<u>ESCALATION FACTOR*</u>	<u>ESCALATED TOTAL</u>
1989	--	\$1,214,197
1990	0.77%	\$1,223,546
1991	1.27%	\$1,239,085
1992	2.21%	\$1,266,469
1993	2.54%	\$1,298,637
1994	2.01%	\$1,324,740
1995	2.01%	\$1,351,367
1996	2.01%	\$1,378,530
1997	2.01%	\$1,406,238
1998	2.01%	\$1,434,503
1999	2.01%	\$1,463,337
<b>TOTAL (1999 Dollars)</b>		<b>\$1,463,337</b>

\*Escalation Factors Taken From Means©

**Pages 4-32 through 4-36 have been deleted. This information is found in Volume 9, Hydrologic Section.**

CONTINGENT SEEDING AND PLANTING

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14-B	Cottonwood Ponds and Ditches	D8 D6 Loader	8.0 8.0 9.0	1 Operator 1 Operator 1 Operator 2 Laborers	8.0 8.0 9.0	930.00 617.00 453.00	1.0 1.0 1.1

Revised 7/14/94

<b>ITEM #</b>	<b><u>DESCRIPTION</u></b>	<b><u>EQUIPMENT</u></b>	<b><u>HOURS</u></b>	<b><u>LABOR</u></b>	<b><u>HOURS</u></b>	<b><u>TOTAL COST</u></b>	<b><u>CONST. DAYS</u></b>
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	Tube	25 Ton Crane	16	Laborers	202		
	Conveyor,	Utility Truck	36	Foreman	16		
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	Conveyor	245 Hyd.	34				
	Portal	Excavator					
		10 yd Dump	48				
		Truck					
		D3 Dozer	30				
		Track Loader	14				
						<u>\$22,846.00</u>	
	Mobilization Construction Cost					\$ 10,000.00	
	+10% Contingency					105,831.00	
	+4.3% Reclamation Management					<u>45,407.00</u>	
	<b>TOTAL CONSTRUCTION COST</b>					<b>\$1,209,646.00</b>	
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Revised 9/7/94

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- XXI - Waste Rock Storage Facility (See Volume 10)

***VEGETATION & SOILS OF THE  
COTTONWOOD/TRAIL MOUNTAIN  
PORTAL AREA***



This document contains the following reports prepared by *MT. NEBO SCIENTIFIC, INC.*:

VEGETATION OF THE  
COTTONWOOD/TRAIL MOUNTAIN  
PORTAL AREA

by  
Patrick D. Collins, Ph.D.

*AND*

SOIL SURVEY REPORT OF THE  
COTTONWOOD/TRAIL MOUNTAIN  
PORTAL AREA

by  
James H. Nyenhuis  
Cert. Professional Soils Scientist  
ARCPACS 2753



***VEGETATION OF THE  
COTTONWOOD/TRAIL MOUNTAIN  
PORTAL AREA***

***FOR  
ENERGY WEST/  
PACIFICORP***



*Prepared by*

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**(801) 489-6937**

**for**

***ENERGY WEST/PACIFICORP***  
**P.O. Box 1005**  
**Huntington, Utah 84528**

**Report: Patrick Collins, Ph.D.**

**February 1994**

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APPENDIX B - Raw Data

## **1.0 SCOPE**

The purpose of this document is to report vegetation data of an area that is proposed for disturbance by future mining activities. Methods used in this report were based on guidelines supplied by the State of Utah, Division of Oil, Gas & Mining (DOG M).

## **2.0 INTRODUCTION**

### **2.1 GENERAL SITE DESCRIPTION**

The Cottonwood/Trail Mountain Portal Area is located in Cottonwood Canyon, approximately 15 miles northwest of the town of Orangeville in Emery County, Utah. It is located near the site of an existing mine previously called the Trail Mountain Mine.

Elevation of the study site was approximately 7,200 ft. Slopes of the study area were about 35 degrees. The native vegetation was dominated by pinyon pine (*Pinus edulis*) and Utah juniper (*Juniperus osterosperma*) trees, with salina wildrye (*Elymus salinus*) as the dominant understory species. There was a small seep also located on the study area. The seep and the vegetation influenced by it appeared to be less than one-tenth of an acre in size.

Two soil map unit were mapped across the study area. The two map units were:

Map Unit A: Lithic Ustorthents, Loamy-Skeletal - Rock Outcrop Complex, 40 to 60% slopes,

Map Unit B: Typic Ustorthents, Loamy-Skeletal, 20 to 40% slopes.

A detailed soil survey, including mapping, description, sampling, laboratory characterization, data evaluation, and report was also prepared of the area. This report was called "Soil Survey Report, Cottonwood/Trail Mountain Portal Area, Trail Mountain, Utah" (Feb. 1994) and was submitted as a separate report.

### **3.0 METHODS**

Methodologies used for this study were performed in accordance with the guidelines supplied by DOGM.

Quantitative and qualitative data were taken on the vegetation of the area proposed for disturbance. Sampling of the proposed disturbed area was conducted on September 8, 1993. The reference area used for a comparison was sampled on September 27, 1991. Nearly identical methods were used in sampling both the proposed disturbed and reference areas.

#### **3.1 TRANSECT AND QUADRAT PLACEMENT**

Transect lines were placed randomly on the area proposed for disturbance and reference area. Once the transect lines were placed, regular points were then marked on them. From these

marks, a random number dictated the direction and distance to place the quadrats at right angles from the transect lines. Cover, frequency, and density were obtained from these sample locations.

### **3.2 COVER AND COMPOSITION**

Cover estimates were made using ocular methods with meter square quadrats. Species composition and relative frequencies were also assessed from the quadrats. Additional information recorded on the raw data sheets were: estimated precipitation, slope, exposure, grazing use, animal disturbance and other appropriate notes.

### **3.3 WOODY SPECIES DENSITY**

Density of woody plant species was recorded using the point quarter distance method (Cotton and Curtis 1956). In this method, random points were placed on the sample sites and measured into four quarters. The distances to the nearest woody plant species were then recorded in each quarter. The average point-to-individual distance was equal to the square root of the mean area per individual.

As mentioned, only woody species densities were recorded. Although the plant Oregon grape (*Mahonia repens*) is somewhat woody at the base, it was not included in the woody species density calculations of this report.

### 3.4 SAMPLE ADEQUACY

Sampling adequacy tests for woody species density and cover were performed using formulas from "Statistical Methods" (Snedocor and Cochran 1980), with the goal that at least ~~80%~~<sup>90%</sup> of the samples were within 10% of the true mean for the plant communities of the area. The formula used is given below.

$$n_{\min} = \left| \frac{1.28 (s)}{x (.1)} \right|^2$$

where,

- nmin = minimum adequate sample
- s = standard deviation
- x = sample mean
- .1 = confidence interval

### 3.5 PHOTOGRAPHS

Color photographs of each sample area was taken at the time of sampling and are submitted with this report. An aerial photograph showing the study area is also included.

### 3.6 RAW DATA

The raw data were also submitted with this report which would facilitate future scrutiny of the data and further statistical testing if desired.

## 4.0 RESULTS

### 4.1 PROPOSED DISTURBED AREA

The proposed disturbed area was within a pinyon-juniper plant community. An aerial photograph showing the proposed disturbed, reference, and adjacent areas is included in this report. Color photographs of the sample areas are also included (see Appendix A).

Total living understory cover was estimated at 31.00% (Table 1). Grasses dominated the cover comprising 48.69% of the total living cover, followed by woody species at 32.76% and forbs at 16.22% (Table 1). The dominate species by cover and frequency was Salina wildrye (*Elymus salinus*), estimated at 15.07% and 96.67%, respectively. The most common woody species were pinyon pine (*Pinus edulis*) and Utah serviceberry (*Amalanchier utahensis*). Forbs were fairly inconsequential in the quadrats, each species comprising less than 2% of the living cover, and usually occurred in less than 20% of the quadrats. For cover and frequency by species, refer to Table 2.

Woody species density was also estimated using the point quarter method. The total density was 1,352 individuals per acre. The species with the highest densities were pinyon pine, mountain mahogany (*Cercocarpus montanus*), and Utah juniper (*Juniperus osteosperma*). For estimated densities of all woody species refer to Table 3.

## 4.2 REFERENCE AREA

A reference area had been used previously for comparisons of another area that has been reclaimed by the operator. This area has been called the "Cottonwood Fan Portal Area" and is located in close proximity to the proposed new disturbance. The reference area had similar slope, exposure, elevation, plant community type, soils, and general physiognomy as the proposed new disturbed area. Therefore, following DOGM approval, this existing reference area will be proposed to also be used as a standard of success for final reclamation of the proposed new disturbance area.

Several data sets are available from previous years' sampling of this reference area. This report includes the results from sampling in 1991 and compares it to the 1993 sampling of the proposed new disturbance area.

Total living understory cover was estimated at 28.75% (Table 4). Grasses were also the dominate lifeform of the plant species in this area comprising 68.13% of the total living cover, followed by woody species and forbs (Table 4). As in the proposed disturbed area, the most common plant species by cover and frequency was Salina wildrye. This grass consisted of 15.40% of the total cover and was present in 85.00% of the sample quadrats (Table 5). Most common woody species were also the same as the proposed disturbed community -- pinyon pine and Utah serviceberry. Forb species again were not as important by cover or frequency.

Woody species density of the reference area was estimated at 624 individuals per acre (Table 6).

## 5.0 DISCUSSION

Similar species were found on both the proposed disturbed and reference areas. When understory cover was compared statistically by Student's t-tests, the differences were not significant. When the woody species densities were compared, however, the proposed disturbed area had a significantly greater number of individuals per acre when compared to the reference area. Therefore, a fair standard for woody species success should be determined by DOGM and the operator. A statistical summary is shown on Table 7.

**TABLE 1:** Total cover and composition summary for the Cottonwood/Trail Mountain Portal Area (1993).

<b>TOTAL COVER</b>	<b>% MEAN COVER</b>	<b>STANDARD DEVIATION</b>	<b>SAMPLE SIZE</b>
Overstory	3.83	7.60	30
Understory	31.00	9.35	30
Litter	12.67	8.63	30
Bareground	12.50	7.61	30
Rock	40.00	16.23	30
<b>COMPOSITION</b>			
Trees/Shrubs	32.76	35.64	30
Forbs	16.22	20.05	30
Grasses	48.69	29.13	30

**TABLE 2: Species cover and frequency summary for the Cottonwood/Trail Mountain Portal Area (1993).**

<b>SPECIES</b>	<b>% MEAN COVER</b>	<b>STANDARD DEVIATION</b>	<b>SAMPLE SIZE</b>	<b>RELATIVE FREQUENCY</b>
<b>TREES &amp; SHRUBS</b>				
<i>Amalanchier utahensis</i>	3.50	8.08	30	16.67
<i>Chrysothamnus nauseosus</i>	1.33	4.27	30	6.67
<i>Eriogonum corymbosum</i>	5.15	6.67	30	6.67
<i>Juniperus osteosperma</i>	0.50	2.69	30	3.33
<i>Mahonia repens</i>	0.60	1.56	30	13.33
<i>Pinus edulis</i>	5.00	10.72	30	20.00
<i>Pseudotsuga menziesii</i>	0.50	2.69	30	3.33
<b>FORBS</b>				
<i>Aquilegia elegantula</i>	1.17	4.02	30	6.67
<i>Aster chilensis</i>	0.50	1.98	30	6.67
<i>Cirsium sp.</i>	2.38	2.38	30	16.67
<i>Cryptantha humilis</i>	0.17	0.90	30	3.33
<i>Haplopappus sp.</i>	1.67	3.25	30	23.33
<i>Lepidium montanum</i>	0.33	1.80	30	3.33
<i>Machaeranthera canescens</i>	0.50	1.50	30	10.00
<b>GRASSES</b>				
<i>Elymus salinus</i>	15.07	9.30	30	96.67
<i>Stipa hymenoides</i>	1.00	3.27	30	10.00

39.37

TABLE 3: Woody species densities of the Cottonwood/Trail Mountain Portal Area (1993).

	<b>NUMBER/ACRE</b>
<i>Amalanchier utahensis</i>	191.58
<i>Ceratoides lanata</i>	11.27
<i>Cercocarpos montanus</i>	360.61
<i>Eriogonum corymbosum</i>	169.04
<i>Juniperus osteosperma</i>	225.38
<i>Pinus edulis</i>	360.61
<i>Pseudotsuga menziesii</i>	11.27
<i>Rhus trilobata</i>	<u>22.54</u>
<b>TOTAL</b>	<b><u>1352.29</u></b>

**TABLE 4:** Total cover and composition summary for the Cottonwood Fan Portal Reference Area (1991).

<b>TOTAL COVER</b>	<b>% MEAN COVER</b>	<b>STANDARD DEVIATION</b>	<b>SAMPLE SIZE</b>
Understory	28.75	9.86	20
Litter	22.75	15.20	20
Bareground	14.25	9.26	20
Rock	34.25	16.15	20
<b>COMPOSITION</b>			
Trees/Shrubs	29.32	36.57	20
Forbs	2.55	5.56	20
Grasses	68.13	35.17	20

**TABLE 5:** Species cover and frequency summary for the Cottonwood Fan Portal Reference Area (1991).

<b>SPECIES</b>	<b>% MEAN COVER</b>	<b>STANDARD DEVIATION</b>	<b>SAMPLE SIZE</b>	<b>RELATIVE FREQUENCY</b>
<b>TREES &amp; SHRUBS</b>				
<i>Amalanchier utahensis</i>	3.25	10.16	20	15.00
<i>Chrysothamnus viscidiflorus</i>	.20	0.68	20	10.00
<i>Ephedra viridis</i>	0.15	0.65	20	5.00
<i>Eriogonum corymbosum</i>	0.65	2.83	20	5.00
<i>Pinus edulis</i>	5.35	10.72	20	25.00
<b>FORBS</b>				
<i>Aster glaucodes</i>	0.35	1.15	20	10.00
<i>Machaeranthera canescens</i>	0.25	1.09	20	5.00
<i>Penstemon sp.</i>	0.10	0.44	20	5.00
<b>GRASSES</b>				
<i>Elymus salinus</i>	15.40	10.20	20	85.00
<i>Stipa hymenoides</i>	3.00	5.57	20	30.00

**TABLE 6: Woody species densities of the Cottonwood Fan Portal Reference Area (1991).**

	<b>NUMBER/ACRE</b>
<i>Amalanchier utahensis</i>	38.97
<i>Atriplex confertifolia</i>	7.79
<i>Cercocarpus montanus</i>	38.97
<i>Chrysothamnus nauseosus</i>	109.12
<i>Ephedra viridis</i>	124.71
<i>Eriogonum corymbosum</i>	15.59
<i>Juniperus osteosperma</i>	31.18
<i>Pinus edulis</i>	241.63
<i>Pseudotsuga menziesii</i>	7.79
<i>Symphoricarpos oreophilus</i>	<u>7.79</u>
<b>TOTAL</b>	<b><u>623.56</u></b>

**TABLE 7:** Statistical summary sheet for the proposed disturbed Cottonwood/Trail Mountain Area and Cottonwood Fan Portal Reference Area.

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<b>PROPOSED DISTURBED</b>			
Understory Cover	x=31.00	s=9.35	n=30
Woody Spp. Density	x=67.24*	s=10.78	n=30
<b>REFERENCE AREA</b>			
Understory Cover	x=28.75	s=9.86	n=20
Woody Spp. Density	x=97.80*	s=22.82	n=20
<b>STATISTICAL ANALYSES</b>			
Understory Cover	t=0.816	df=48	SL=NS
Woody Spp. Density	t=-6.368	df=48	SL=p<.005

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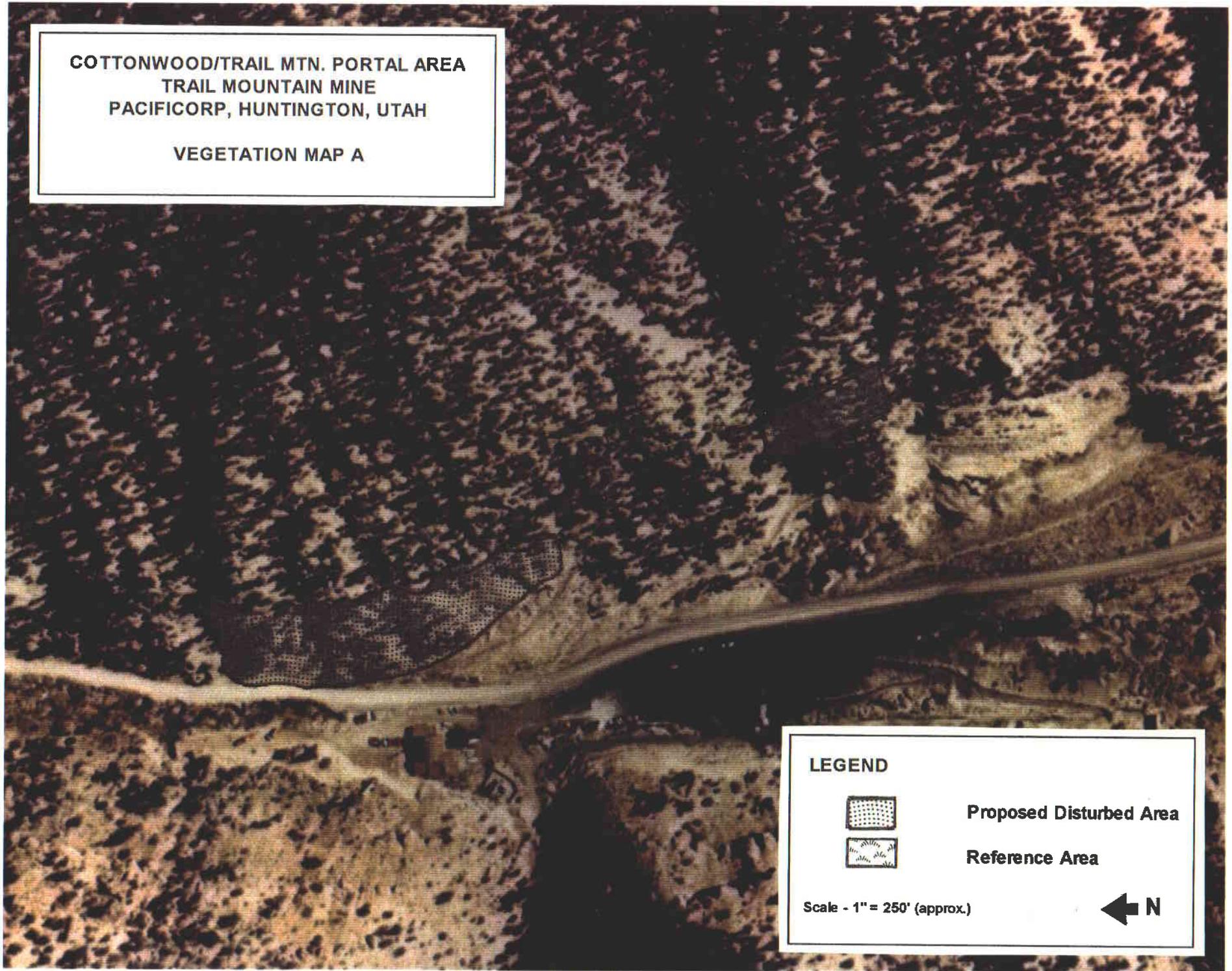
x = sample mean, s = sample standard deviation,  
n = sample size, NS = nonsignificant,  
\* mean number of inches to each sample point

**APPENDIX A**

**Color Photographs**

COTTONWOOD/TRAIL MTN. PORTAL AREA  
TRAIL MOUNTAIN MINE  
PACIFICORP, HUNTINGTON, UTAH

VEGETATION MAP A



LEGEND



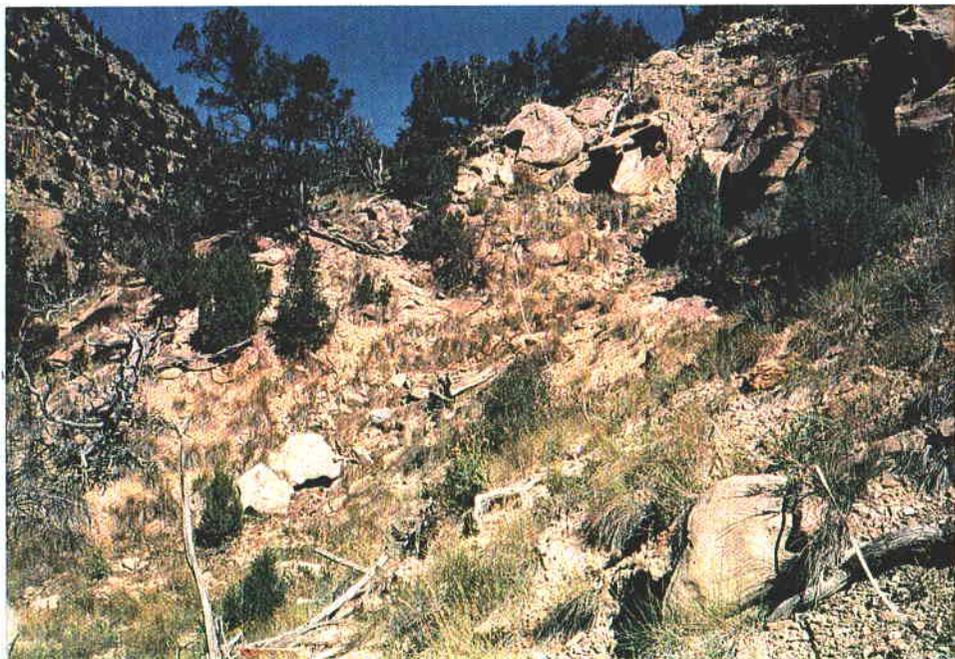
Proposed Disturbed Area



Reference Area

Scale - 1" = 250' (approx.)





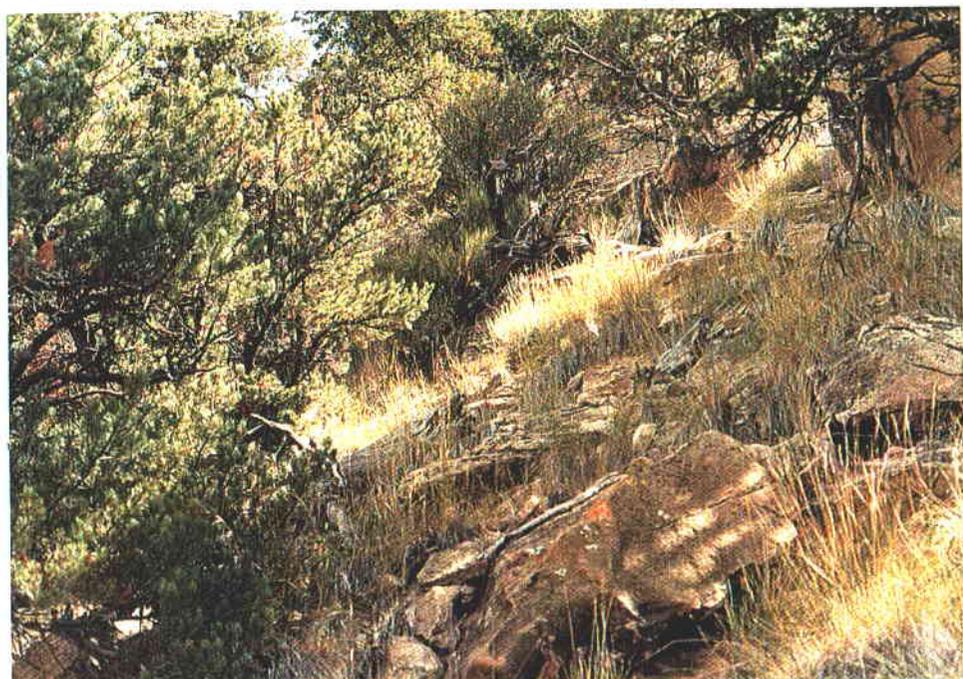
Cottonwood/Trail Mountain Portal  
Proposed Disturbed Area (a)



Cottonwood/Trail Mountain Portal  
Proposed Disturbed Area (b)



Cottonwood Fan Portal



Cottonwood Fan Portal

## **APPENDIX B**

### **Raw Data**

ENERGY WEST  
COTTONWOOD/TRAIL MOUNTAIN

Portal Area

Exposure: SW

Slope: 36 deg.

Sample Date: 8 Sept 1993

1.00 2.00 3.00 4.00 5.00 6.00 7.00 8.00 9.00 10.00

TREES & SHRUBS

<i>Amalanchier utahensis</i>	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Chrysothamnus nauseosus</i>	10.00	0.00	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Pinus edulis</i>	0.00	0.00	25.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Eriogonum corymbosum</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Juniperus oosterosperma</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Mahonia repens</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Pseudotsuga menziesii</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

FORBS

<i>Machaeranthera canescens</i>	5.00	0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Aster chilensis</i>	5.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Cirsium</i> sp.	0.00	0.00	0.00	0.00	5.00	0.00	0.00	0.00	5.00	5.00
<i>Lepidium montanum</i>	0.00	0.00	0.00	0.00	0.00	10.00	0.00	0.00	0.00	0.00
<i>Aquilegia elegantula</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00	10.00
<i>Haplopappus</i> sp.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00	5.00	0.00
<i>Cryptantha humilis</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

GRASSES

<i>Elymus salinus</i>	15.00	30.00	10.00	30.00	15.00	10.00	45.00	15.00	15.00	20.00
<i>Stipa hymenoides</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

COVER

Overstory	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Understory	45.00	40.00	40.00	40.00	20.00	25.00	45.00	30.00	25.00	35.00
Litter	15.00	10.00	5.00	25.00	10.00	5.00	10.00	10.00	5.00	10.00
Bareground	20.00	30.00	5.00	30.00	15.00	10.00	10.00	10.00	10.00	25.00
Rock	20.00	20.00	50.00	5.00	55.00	60.00	35.00	50.00	60.00	30.00

% COMPOSITION

Shrubs	44.44	0.00	62.50	25.00	0.00	0.00	0.00	0.00	0.00	0.00
Forbs	22.22	25.00	12.50	0.00	25.00	40.00	0.00	50.00	40.00	42.86
Grasses	33.33	75.00	25.00	75.00	75.00	40.00	100.00	50.00	60.00	57.14

ENERGY WEST  
 COTTONWOOD/TRAIL MOUNTAIN  
 Portal Area  
 Exposure: SW  
 Slope: 36 deg.  
 Sample Date: 8 Sept 1993

24.00	25.00	26.00	27.00	28.00	29.00	30.00	Mean	SDev	Freq	
<hr/>										TREES & SHRUBS
30.00	0.00	0.00	0.00	0.00	0.00	0.00	3.50	8.08	16.67	Amalanchier utahensis
0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.33	4.27	6.67	Chrysothamnus nauseosus
0.00	0.00	0.00	0.00	0.00	20.00	0.00	5.00	10.72	20.00	Pinus edulis
0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.33	5.15	6.67	Eriogonum corymbosum
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	2.69	3.33	Juniperus osterosperma
0.00	5.00	3.00	0.00	0.00	0.00	0.00	0.60	1.56	13.33	Mahonia repens
0.00	0.00	15.00	0.00	0.00	0.00	0.00	0.50	2.69	3.33	Pseudotsuga menziesii
<hr/>										FORBS
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	1.50	10.00	Machaeranthera canescens
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	1.98	6.67	Aster chilensis
0.00	10.00	0.00	0.00	0.00	0.00	0.00	1.00	2.38	16.67	Cirsium sp.
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	1.80	3.33	Lepidium montanum
0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.17	4.02	6.67	Aquilegia elegantula
0.00	10.00	0.00	0.00	0.00	5.00	0.00	1.67	3.25	23.33	Haplonappus sp.
0.00	0.00	0.00	5.00	0.00	0.00	0.00	0.17	0.90	3.33	Cryptantha humilis
<hr/>										GRASSES
5.00	15.00	2.00	15.00	25.00	20.00	15.00	15.07	9.30	96.67	Elymus salinus
0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	3.27	10.00	Stipa hymenoides
<hr/>										COVER
0.00	0.00	15.00	0.00	0.00	25.00	0.00	3.83	7.60		Overstory
35.00	40.00	5.00	20.00	25.00	20.00	20.00	31.00	9.35		Understory
40.00	20.00	20.00	5.00	10.00	10.00	10.00	12.67	8.63		Litter
5.00	15.00	10.00	10.00	10.00	10.00	5.00	12.50	7.61		Bareground
20.00	25.00	50.00	65.00	55.00	35.00	65.00	40.00	16.23		Rock
<hr/>										% COMPOSITION
85.71	12.50	90.00	0.00	0.00	44.44	0.00	32.76	35.64		Shrubs
0.00	50.00	0.00	25.00	0.00	11.11	0.00	16.22	20.05		Forbs
14.29	37.50	10.00	75.00	100.00	44.44	75.00	48.69	29.13		Grasses

11.00	12.00	13.00	14.00	15.00	16.00	17.00	18.00	19.00	20.00	21.00	22.00	23.00
0.00	0.00	0.00	0.00	0.00	30.00	0.00	10.00	0.00	10.00	0.00	0.00	15.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	35.00	35.00	0.00	10.00	0.00	0.00	25.00	0.00	0.00	0.00
25.00	0.00	0.00	0.00	0.00	0.00	15.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00	5.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	20.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	5.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.00	0.00	0.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5.00	10.00	25.00	15.00	5.00	0.00	5.00	15.00	20.00	5.00	15.00	15.00	15.00
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.00	10.00	0.00	5.00	0.00
0.00	0.00	0.00	10.00	10.00	0.00	10.00	0.00	0.00	25.00	0.00	0.00	20.00
35.00	40.00	35.00	40.00	30.00	30.00	30.00	45.00	35.00	25.00	20.00	25.00	30.00
10.00	25.00	15.00	5.00	10.00	5.00	10.00	5.00	5.00	10.00	5.00	30.00	25.00
20.00	10.00	25.00	5.00	5.00	5.00	10.00	25.00	10.00	5.00	10.00	10.00	5.00
35.00	25.00	25.00	40.00	45.00	60.00	40.00	25.00	50.00	35.00	65.00	35.00	20.00
71.43	0.00	0.00	70.00	87.50	100.00	62.50	66.67	0.00	70.00	0.00	20.00	70.00
14.29	75.00	28.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.00	0.00	0.00
14.29	25.00	71.43	30.00	12.50	0.00	12.50	33.33	100.00	30.00	75.00	80.00	30.00

U.P. & L. FAN PORTAL AREA  
 REF. AREA for Reveg. Slopes  
 Cottonwood Fan Portal Area  
 Sample Date: 27 Sept 1991  
 Exposure: West  
 Slope: 35 deg.

	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00
<b>TREES &amp; SHRUBS</b>										
<i>Pinus edulis</i>	0.00	20.00	25.00	10.00	0.00	0.00	40.00	0.00	0.00	0.00
<i>Amelanchier utahensis</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	15.00
<i>Eriogonum corymbosum</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Ephedra viridis</i>	3.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Chrysothamnus viscidiflor</i>	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>FORBS</b>										
<i>Macharenthera canescens</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Penstemon sp.</i>	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<i>Aster glaucodes</i>	2.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
<b>GRASSES</b>										
<i>Elymus salinus</i>	20.00	20.00	5.00	10.00	20.00	20.00	10.00	20.00	35.00	0.00
<i>Dryzopsis hymenoides</i>	0.00	0.00	5.00	0.00	5.00	0.00	0.00	0.00	0.00	5.00
<b>COVER</b>										
Total Living Cover	30.00	40.00	35.00	20.00	25.00	20.00	50.00	20.00	35.00	20.00
Litter	15.00	25.00	35.00	55.00	20.00	20.00	5.00	40.00	5.00	5.00
Bareground	20.00	5.00	5.00	5.00	20.00	5.00	30.00	20.00	5.00	20.00
Rock	35.00	30.00	25.00	20.00	35.00	55.00	15.00	20.00	55.00	55.00
<b>% COMPOSITION</b>										
Shrubs	26.67	50.00	71.43	50.00	0.00	0.00	80.00	0.00	0.00	75.00
Forbs	6.67	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Grasses	66.67	50.00	28.57	50.00	100.00	100.00	20.00	100.00	100.00	25.00

11.00 12.00 13.00 14.00 15.00 16.00 17.00 18.00 19.00 20.00

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12.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00  
0.00 0.00 5.00 45.00 0.00 0.00 0.00 0.00 0.00 0.00  
13.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00  
0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00  
0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00

0.00 5.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00  
0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 2.00  
0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 5.00 0.00

0.00 30.00 10.00 0.00 35.00 20.00 15.00 10.00 10.00 18.00  
0.00 0.00 0.00 0.00 0.00 20.00 0.00 15.00 10.00 0.00

---

25.00 35.00 15.00 45.00 35.00 40.00 15.00 25.00 25.00 20.00  
35.00 25.00 10.00 10.00 40.00 10.00 30.00 15.00 5.00 50.00  
5.00 20.00 15.00 20.00 5.00 5.00 35.00 20.00 5.00 20.00  
35.00 20.00 60.00 25.00 20.00 45.00 20.00 40.00 65.00 10.00

---

100.00 0.00 33.33 100.00 0.00 0.00 0.00 0.00 0.00 0.00  
0.00 14.29 0.00 0.00 0.00 0.00 0.00 0.00 20.00 10.00  
0.00 85.71 66.67 0.00 100.00 100.00 100.00 100.00 80.00 90.00

---

U. P. & L. FAN PORTAL AREA  
 REF. AREA for Reveg. Slopes  
 Cottonwood Fan Portal Area  
 Sample Date: 27 Sept 1991  
 Exposure: West  
 Slope: 35 deg.

Mean	SDev	Freq	
<hr/>			
			TREES & SHRUBS
5.35	10.72	25.00	<i>Pinus edulis</i>
3.25	10.16	15.00	<i>Amelanchier utahensis</i>
0.65	2.83	5.00	<i>Eriogonum corymbosum</i>
0.15	0.65	5.00	<i>Ephedra viridis</i>
0.25	1.09	5.00	<i>Chrysothamnus viscidiflorus</i>
			FORBS
0.25	1.09	5.00	<i>Macharenthera canescens</i>
0.10	0.44	5.00	<i>Penstemon</i> sp.
0.35	1.15	10.00	<i>Aster glaucodes</i>
			GRASSES
15.40	10.20	86.00	<i>Elymus salinus</i>
3.00	5.57	30.00	<i>Dryopsis hymenoides</i>
<hr/>			
			COVER
28.75	9.86		Total Living Cover
22.75	15.20		Litter
14.25	9.26		Bareground
34.25	16.15		Rock
<hr/>			
			% COMPOSITION
29.32	36.57		Shrubs
2.55	5.56		Forbs
68.13	35.17		Grasses
<hr/>			

***SOIL SURVEY REPORT OF THE  
COTTONWOOD/TRAIL MOUNTAIN  
PORTAL AREA***

***FOR  
ENERGY WEST/  
PACIFICORP***



*Prepared by*

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**February 1993**

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## **1.0 INTRODUCTION**

This report is prepared subsequent to a field study performed to characterize the soil resources and potential soil reclamation material of the proposed Cottonwood/Trail Mountain Portal Area. The project site is approximately 3 acres in size and is located on canyon lower sideslopes just east of the Cottonwood Canyon road across from the PacifiCorp Trail Mountain underground coal mine near Huntington, Utah. The Trail Mountain Mine is approximately 15 miles west-northwest of Huntington, in Cottonwood Canyon of the Wasatch Plateau.

### **1.1 OBJECTIVES**

The basic objectives of the field investigations were to map and sample the soils of the study area in sufficient detail to characterize their physical and chemical properties and depths to which they may be salvaged as a source of topsoil for reclamation purposes. Thus, the site-specific characteristics of the soil that may influence soil salvage, stockpiling, and redistribution were inventoried. A detailed soil survey, including mapping, description, sampling, laboratory characterization, data evaluation, and report preparation was needed to generate the required information.

The general objectives relating to the soil survey are as follows:

- Satisfy the soils requirements of the State of Utah Department of Natural Resources Division of Oil, Gas and Mining (UDOGM) as found in UDOGM Guidelines for Management of Topsoil and Overburden for Underground and Surface Mining (Leatherwood and Duce, 1988);
- Collect and review all pertinent existing soils, geologic, and other pertinent information to gain a basic understanding of the characteristics of the soils on site;
- Describe, sample, analyze (laboratory), evaluate, and report site-specific soils and soil substitute data;
- Prepare a soils map, depicting the soil map units and associated recommended suitable soil salvage depths, which can be used in reclamation planning; and
- Prepare a soils report to aid in the completion of the reclamation planning documents needed for final permit application approval.

## **2.0 METHODS - SCOPE OF WORK**

### **2.1 DATA REVIEW AND EVALUATION**

All existing soils and related discipline information for the general study area was compiled, reviewed, and evaluated prior to initiation of the soils field work. This review included: (1) the existing general soils information for the previous Cottonwood/Wilberg Mine Permit Area (revised 6-6-89), and (2) unpublished Manti-LaSal National Forest Service (FS) soils information for nearby Trail Mountain which includes map units on steep canyon sides which are similar to the Cottonwood/Trail Mountain study area. The Soil Conservation Service (SCS) Soil Survey of Carbon Area, Utah (Jensen and Borchert, 1988) does not include the study area, although the SCS survey includes information for similar canyon sideslope landscapes.

Project maps and air photos were also reviewed to become familiar with the study area and locate dominant topographic features of the project area as well as probable access routes to and from the acreage to be characterized.

It should be noted that all methods for soil survey work performed as part of this project are standard methods for detailed Order 1 soil surveys. All procedures and methods were in accordance with current SCS, FS, and State of Utah reclamation-related soil survey methods for coal mining and related projects. Furthermore, all technical specifications were in accordance with current standards and procedures of the USDA-SCS National Cooperative Soil Survey Program.

### **2.2 SOIL MAPPING**

Mr. Jim Nyenhuis, a certified professional soil scientist/soil classifier (ARCPACS 2753), mapped soils and soil-substitute materials at the Order 1 level of intensity for all of the study area on October 30, 1993. The mapping was done on the best available base map(s) of the study area.

The purpose of the survey was to provide PacifiCorp with a detailed soils map of the study area that can be used for determination of suitable and unsuitable soil characteristics, as well as subsequent determination of soil salvageability. Therefore, site-specific characteristics of the soils

and soil-substitute materials that may influence soil suitability, salvage, stockpiling, and redistribution were emphasized.

All standards and procedures for soil mapping and profile description were in accordance with current SCS methods, as described in the recently revised Soil Survey Manual (Soil Survey Staff 1992); National Soils Handbook, as currently amended (Soil Survey Staff 1992); and Keys to Soil Taxonomy, fifth edition (Soil Survey Staff 1992), and applicable UDOGM topsoil and overburden guidelines (Leatherwood and Duce 1988).

Criteria to establish suitability of soil (topsoil) or soil substitute material were those contained in Table 2 of UDOGM "Guidelines for Management of Topsoil and Overburden for Underground and Surface Coal Mining" (Leatherwood and Duce 1988).

Upon initiation of soils field work, each soil type was located on the ground. Within each map unit, traverses were walked to determine overall map unit characteristics. Many soil auger holes were dug and examined in visually representative locations. Several artificial cut exposures that exist throughout the study area were also observed. Based on these preliminary observations, three sites characteristic of the three dominant soils were selected for detailed soil pedon description and sampling.

### **2.3 SOIL SAMPLING AND PROFILE DESCRIPTION**

Each soil pedon was described according to current methods and standards of the National Cooperative Soil Survey. Descriptions were completed to a variable depth depending largely on rock fragment content of the substratum, and depth to shallow sandstone or shale bedrock. The following parameters were described, by horizon, for each soil pedon description: horizon symbol, depth, and boundary; color; texture; structure; consistence; coarse fragment content; and the amount, size, and depth of major roots. In addition, general site information was recorded at each sampling site including: existing dominant vegetation, physiography-landform, slope, aspect, erosion condition, drainage class, and depth to a saturated zone or ground water if encountered.

Each mapped soil type (established soil series or unnamed soil, or soil-substitute material) was fully described at a typical location a minimum of one time each. An adequate amount of

representative soil material was collected from each major soil horizon of undistributed soils at the sampling locations of the described soil pedons. These soil samples were submitted to the laboratory for the requested soil characterization. Subsequent to soil laboratory analysis, the remaining soil sample material was archived should any future analysis be required.

## **2.4 SOIL LABORATORY ANALYSIS**

The UDOGM soils guideline requires laboratory analysis of soil samples. The samples were sent to Colorado State University's Soil Testing Laboratory for standard and special analyses as specified in Table 1 (Analytical Methods for Baseline Soils Data) of the UDOGM soils guideline (Leatherwood and Duce, 1988). Specified parameters include:

- Soil Color (Munsell notation) - determined in the field
- Soil Texture (% sand, silt, clay - hydrometer method)
- pH (standard units based on saturated paste)
- Organic Carbon (%)
- Saturation Percentage
- Alkalinity (meq/liter)
- Electrical Conductivity (EC) - mmhos/cm @ 25 degrees C
- CaCO<sub>3</sub> (%)
- Soluble Potassium, Magnesium, Calcium & Sodium (meq/liter)
- Sodium Adsorption Ratio (SAR) - calculated from soluble K, Mg, Ca, and Na (meq/l)
- Exchangeable Sodium Percentage (ESP) - analyzed on samples with SAR greater than 12 for clay textured soils or greater than 15 for sandy textured soils
- Total N (Kjeldahl nitrogen %)
- Available Phosphorus (mg/kg NaHCO<sub>3</sub> Olsen's P)
- Available Water Capacity (in/in), including g/cm<sup>3</sup> bulk density
- Rock Fragments (% volume) - determined in the field

For this project, soil samples were not analyzed for:

- Selenium (extractable and/or total);
- Boron (hot water extractable); and
- Acid-Base Potential (with sulfur fractionation).

## **2.5 DATA EVALUATION AND REPORT PREPARATION**

All field and laboratory data has been analyzed and evaluated using standard soil classification, and project-specific soil suitability and interpretation criteria. Natural, non-disturbed soils were classified according to current Soil Taxonomy criteria as stated in fifth edition of Keys to Soil Taxonomy (Soil Survey Staff 1992), and correlated to Utah SCS soil series as appropriate.

Correlation of site-specific soils with SCS soil series allows for reference to established SCS soil interpretations values such as hydrologic group number (for runoff modeling), "K" factors (for use in water erosion hazard evaluations), and "WEG" group number (wind erodibility group status for wind erosion hazard evaluation) for the site-specific soils. In addition, one may quantitatively determine the "K" factor and "WEG" from use of laboratory data and appropriate nomographs.

All soils have been evaluated against topsoil suitability criteria contained in the UDOGM guideline and deemed appropriate for this project. All unsuitable soil horizons or whole soils have been listed and the limitations described.

### **3.0 RESULTS AND DISCUSSION**

#### **3.1 SOIL SURVEY MAP**

The distribution of each soil map unit on the study area is provided on an 1"=100' approximate scale topographic base map (Soil Map T) and also on an 1"=250' approximate scale air photo print enlargement, aerial flight dated 10-31-89, (Soil Map P) accompanying this report as Appendix A. The legend on the maps includes all map unit symbols and names, and typifying soil description/sample sites within the study area.

Two soil map units were mapped across the study area. The two map units are:

- Map Unit A: Lithic Ustorthents, Loamy-Skeletal - Rock Outcrop Complex, 40 to 60% slopes
- Map Unit B: Typic Ustorthents, Loamy-Skeletal, 20 to 40% slopes

#### **3.2 SOIL MAP UNIT AND PROFILE DESCRIPTIONS**

As stated above, two map units were set up and mapped across the study area. These were sufficient to characterize the soil resources on such a small study area of basically similar landscape features. Three soil profiles were described and sampled at representative locations distributed across the study area, TM-1, TM-2, and TM-3. Both TM-1 and TM-2 soils are included in Map Unit A. They are both classified as loamy-skeletal, mixed, frigid Lithic Ustorthents, with the main difference between them being that TM-1 was developed in shallow residuum from and over shale and TM-2 in shallow residuum from and over sandstone. Both were correlated to the Reva soil series. TM-3 typifies Map Unit B. It classified as a loamy-skeletal, mixed, frigid Typic Ustorthent, and is a deep soil developed in mixed colluvium from sandstone and shale. TM-3 was correlated to the Pathead soil series. Map Units A and B, as well as profile descriptions for Reva (TM-1, TM-2), and Pathead (TM-3), will be described in turn.

### **3.2.1 Map Unit A**

Map Unit A is composed of 70% loamy-skeletal Lithic Ustorthents (Reva soil series), and 28% Rock Outcrop. Lithic Ustorthents are split evenly between those over shale (TM-1, 40%) and those over sandstone (TM-2, 40%). Included in Map Unit A is an unnamed, somewhat poorly to poorly drained, shallow soil that occupies a couple of very narrow (less than 1 to about 1.5 feet across), very short drainageways that are present within the study area, and drain downslope toward the Cottonwood Canyon road. This "soil" composes only 1 to 2% of the map unit and constitutes less than 0.2% of an acre in cumulative size. It was not sampled due to its small size and low percent of the study area.

Rock Outcrop are most often exposed areas of bedrock. These areas can be nearly vertical cliff walls or rubble lands. Rubble lands are those areas where the soils are covered by large boulders so close together that there is little soil area between the boulders.

Map Unit A occupies the steep, west-facing lower mountain sideslopes of Cottonwood Canyon across the road from the Trail Mountain Mine. Elevation ranges from about 7300 to 7400 MSL. Slopes are generally steep, averaging 40 to 60 percent. Soils are developing in shallow residuum from interbedded sandstone and shale. Underlying geology is the Upper Cretaceous Mesaverde Group Star Point or Blackhawk formation (Spieker, 1931). Broad vegetative type is pinyon-juniper with some mountain brush. Mean annual precipitation is about 14 to 18 inches. Mean annual air temperature is about 40 to 48 degrees F. Freeze-free period is about 60 to 100 days.

The Reva soil series was described and sampled at both the TM-1 and TM-2 representative locations. TM-1 is located on a steep, west-facing canyon sideslope with slope of 60 percent. Vegetation is Pinyon-Juniper with some mountain brush and grass. It is well drained and the shallow profile was dry at the time of sampling. The soil parent material is thin slopewash colluvium over residuum from mixed sedimentary rocks, primarily shale at this location. The "A" horizon is composed of three 1" bands of slopewash material. The surface is very cobbly. Permeability is very slow. Erosion is moderate at the sampling location although the hazard for water erosion is severe. A soil profile/landscape photograph of the Reva soil (TM-1) is included in Appendix B. The Reva pedon description at the TM-1 location is as follows:

A - 0 to 3" light yellowish brown (10YR 6/4) and very pale brown (10YR 8/4) shaly silty clay loam, yellowish brown (10YR 5/4) moist; 30% small shale chip coarse fragments; weak coarse platy structure; slightly hard, friable, very sticky and very plastic consistence; few fine and very fine roots; strongly effervescent; moderately alkaline (pH 8.2); gradual wavy boundary.

Cr - 3"+ slightly weathered shale.

The Reva TM-2 location is very similar to TM-1 except the soil is developing in slopewash colluvium and residuum from sandstone. TM-2 is on a steep, west-facing sideslope with 60% slope. Vegetation is Pinyon-Juniper. Drainage is well. Erosion condition is moderate; erosion hazard from water is severe. Permeability is moderately rapid. A soil profile/landscape photograph of the Reva soil (TM-2) is included in Appendix B. The Reva pedon description at the TM-2 location is as follows:

AC - 0 to 5" brown (10YR 5/3) very cobbly sandy loam, brown to dark brown (10YR 4/3) moist; 15% gravels, 20% cobbles, and 5% stones and boulders; weak massive structure; slightly hard, friable, slightly sticky and slightly plastic consistence; common medium, fine, and very fine roots; strongly effervescent; moderately alkaline (pH 7.9); clear wavy boundary.

R - 5"+ hard sandstone bedrock.

### **3.2.2 Map Unit B**

Map Unit B is composed of 100% loamy-skeletal Typic Ustorthents (Pathead soil series). Due to the very small size of the one delineation of Map Unit B, no other soils or inclusions are present. Map Unit B occupies a west-facing, short fan at the bottom of a ridge sideslope. The fan was previously cut into when a subsoil storage location for a previous project was established. The artificial cut well exposes the Pathead soil profile. The Map Unit B delineation of this short fan starts at this cut and goes upslope for a short distance. Slopes range from 20 to 40 percent. The Pathead soil is developing in slopewash colluvium from mixed sedimentary rocks. Elevation is about 7305 to 7335 feet. Underlying geology, precipitation, temperature, and freeze-free period is similar to Map Unit A. Broad vegetative type is mixed with some Pinyon/Juniper, sage, and grass.

The Pathead soil series was described and sampled at the TM-3 location. It is well drained and the profile was dry at the time of sampling. Slope gradient at the sampling location is 35 percent. Two photographs (1 soil profile and 1 landscape) of the Pathead soil (TM-3) is included in Appendix B. The Pathead profile description is as follows:

A - 0 to 6" brown (10YR 5/3) very gravelly sandy loam, brown to dark brown (10YR 4/3) moist; 15% gravels, 10% cobbles, and 10% stones; moderate medium granular structure; slightly hard, friable, nonsticky and nonplastic consistence; common coarse, medium, fine, and very fine roots to 10"; moderately effervescent; moderately alkaline (pH 8.2); gradual wavy boundary.

C1 - 6 to 30" light yellowish brown (10YR 6/4) very gravelly sandy loam, yellowish brown (10YR 5/4) moist; 15% gravels, 10% cobbles, and 10% stones; massive structure; slightly hard-hard, friable, nonsticky and nonplastic consistence; few coarse, medium, fine, and very fine roots 10 to 30"; moderately effervescent; moderately alkaline (pH 8.2); gradual boundary.

C2 - 30 to 48" light yellowish brown (10YR 6/4) very gravelly sandy loam, yellowish brown (10YR 5/4) moist; 25% gravels, 10% cobbles, and 10% stones; massive structure; hard, friable, slightly sticky and slightly plastic consistence; moderately effervescent; moderately alkaline (pH 8.1); gradual wavy boundary.

C3 - 48 to 68"+ light yellowish brown (2.5Y 6/4) very gravelly sandy loam-loam, light olive brown (2.5Y 5/4) moist; 25% gravels, 10% cobbles, and 10% stones; massive structure; hard, friable, slightly sticky and slightly plastic consistence; strongly effervescent; moderately alkaline (pH 8.2).

### **3.3 SOIL LABORATORY RESULTS**

The results of laboratory analysis of all soil samples collected during the field study and submitted to CSU's Soil Testing Laboratory are provided in Appendix C. Six soil samples were collected from three soil profiles.

One soil analysis methodology used by the CSU laboratory was slightly different from that recommended in Table 1 of the UDOGM guideline. CSU used a NaHCO<sub>3</sub> extract (Olsen's P) for

available phosphorus which is an acceptable substitute method based on previous discussion with Henry Sauer, UDOGM soil scientist (Sauer, 1993).

Coarse fragment percent was obtained in the field and reported with the lab data results, as well as listed on the field soil profile descriptions. The percent gravels (2mm-3"), cobbles (3-10"), and stones and boulders (>10") were determined by screening with a #10 2mm screen (for gravels) and ocular estimates (for cobbles, and stones and boulders).

Data for duplicate analyses are also included with the results and satisfy quality assurance/quality control (QA/QC) concerns. The duplicate values were comparable within normal limits for the soil parameters.

Results indicate the soils are (1) moderately alkaline with pH 7.9 to 8.2; (2) have generally low salinity, except for depths below 30" in the Pathead soil - Map Unit B; (3) have low sodicity with SAR values below 6.7; (4) have reasonable saturation percent values; (5) have very gravelly sandy loam textures when over sandstone, and silty clay loam textures when over shale; (6) have low nitrogen values; (7) and have moderate to high calcium carbonate contents.

### **3.5 SOIL SUITABILITY EVALUATION AND VOLUME OF SUITABLE SOIL FOR RECLAMATION**

A reclamation potential suitability evaluation of each sampled soil profile was performed based on comparison with criteria and threshold values contained in Table 2 (Overburden Evaluation for Vegetative Root Zone) on page 16 of the UDOGM guideline (Leatherwood and Duce, 1988). A copy of the UDOGM table is included as Table 1 in this report. The following is a brief discussion of the reclamation suitability of the soils on the proposed Cottonwood/Trail Mountain Portal Area.

The Reva soil of Map Unit A (sample locations TM-1 and TM-2) basically has suitable chemical parameters. TM-1 has a high calcium carbonate content (43%) but this parameter is not part of the UDOGM suitability table. The problem with Map Unit A is physical. The very steep slopes (40 to 60% or more), rocky nature of the soil surface with many boulders present, very shallow

**TABLE 1**  
**SOIL SUITABILITY CRITERIA**

UDOGM: Overburden Evaluation for Vegetative Root Zone\*

Parameters	Good	Fair	Poor	Unacceptable
pH	6.1-8.2	5.1 to 6.1 8.2 to 8.4	4.5 to 5.0 8.5 to 9.0	less than 4.5 greater than 9.0
Ec mmhos/cm 25°C	0 to 2	2 to 8	8 to 15	greater than 15
Saturation %	25%-80%		less than 25% greater than 80%	
Texture	sl, l, sil, scl, vfsl, fsl	c, sicl, sc, ls, lfs	sic, s, sc, c, cos, fs, vfs	g, vcos
SAR	0-4	5-10	10-12 Fine Texture 10-15 Coarse Texture	12 Fine Texture 15 Coarse Texture
Selenium	less than 0.1 mg/Kg			greater than 0.1 mg/Kg
Boron	less than 5.0 mg/Kg			greater than 5.0 mg/Kg
Acid/Base Potential	<u>greater than -5 tons CaCO<sub>3</sub></u> 1,000 tons material			<u>less than -5 tons CaCO<sub>3</sub></u> 1,000 tons material
% Coal fines	Undetermined at this time			
Available water capacity (in/in)	greater than 0.10	0.05-0.10	less than 0.05	
Rock Fragments (% volumes)				
3 inches	0-15	15-25	25-30	greater than 30
3-10 inches	0-15	15-25	25-30	greater than 30
10 inches	0-3	3-7	7-10	greater than 10

Many native species have their roots in soils that are determined unsuitable by these values. Occasionally soil materials rated good by these standards have poor vegetation success. Therefore, plant growth trails may be required where reestablishment of native species is desirable.

soil depths (3 to 5" to bedrock), moderate to high coarse fragment content of the soil profiles, and 28% of the map unit composed of rock outcrop negates the possibility of soil salvage.

By contrast, the Pathead soil of Map Unit B has some suitable soil which could be salvaged for use in reclamation. All chemical and physical parameters in the top 30 inches of the soil profile are suitable. Available water capacity is adequate. Below 30 inches, electrical conductivity (EC) values are poor (EC 8.7 for 30 to 48") to unacceptable (EC 24.6 for 48 to 68"), and rock fragment content is fair to poor (25% gravels). Slope gradients are less than 40 percent on which soil can be salvaged. As a result, a potential soil salvage recommendation of 30 inches (2.5 feet) is proposed for Map Unit B. Only one delineation of Map unit B is present on the study area, and its size is small, about 0.16 acre. A potential suitable soil volume of 645 cubic yards is available for salvage on the study area.

In summary, most of the proposed Cottonwood/Trail Mountain Portal Area has soil which can not be salvaged due to steep slope, surface and profile rock content, and very shallow soil depth of 3 to 5 inches. One small area, a Map Unit B delineation of 0.16 acre, has 2.5 feet of suitable soil which can be salvaged if needed. An approximate 645 cubic yards of soil material is available for salvage from Map Unit B for use in future reclamation activities.

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**APPENDIX A**

**Soil Map P & Soil Map T**

**LEGEND**

Map Unit A LITHIC USTORTHENTS, Loamy-skeletal -  
Rock Outcrop Complex, 40 - 60% slopes

Map Unit B TYPIC USTORTHENTS, Loamy-skeletal,  
20 - 40% slopes

○ Soil Description/Sample site

— Study Area Boundary



Scale - 1" = 250' (approx.)

COTTONWOOD/TRAIL MTN. PORTAL AREA  
TRAIL MOUNTAIN MINE  
PACIFICORP, HUNTINGTON, UTAH

**SOIL MAP P**





**LEGEND**

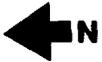
Map Unit A LITHIC USTORTHENTS, Loamy-skeletal -  
Rock Outcrop Complex, 40 - 60% slopes

Map Unit B TYPIC USTORTHENTS, Loamy-skeletal,  
20 - 40% slopes

3● Soil Description/Sample site

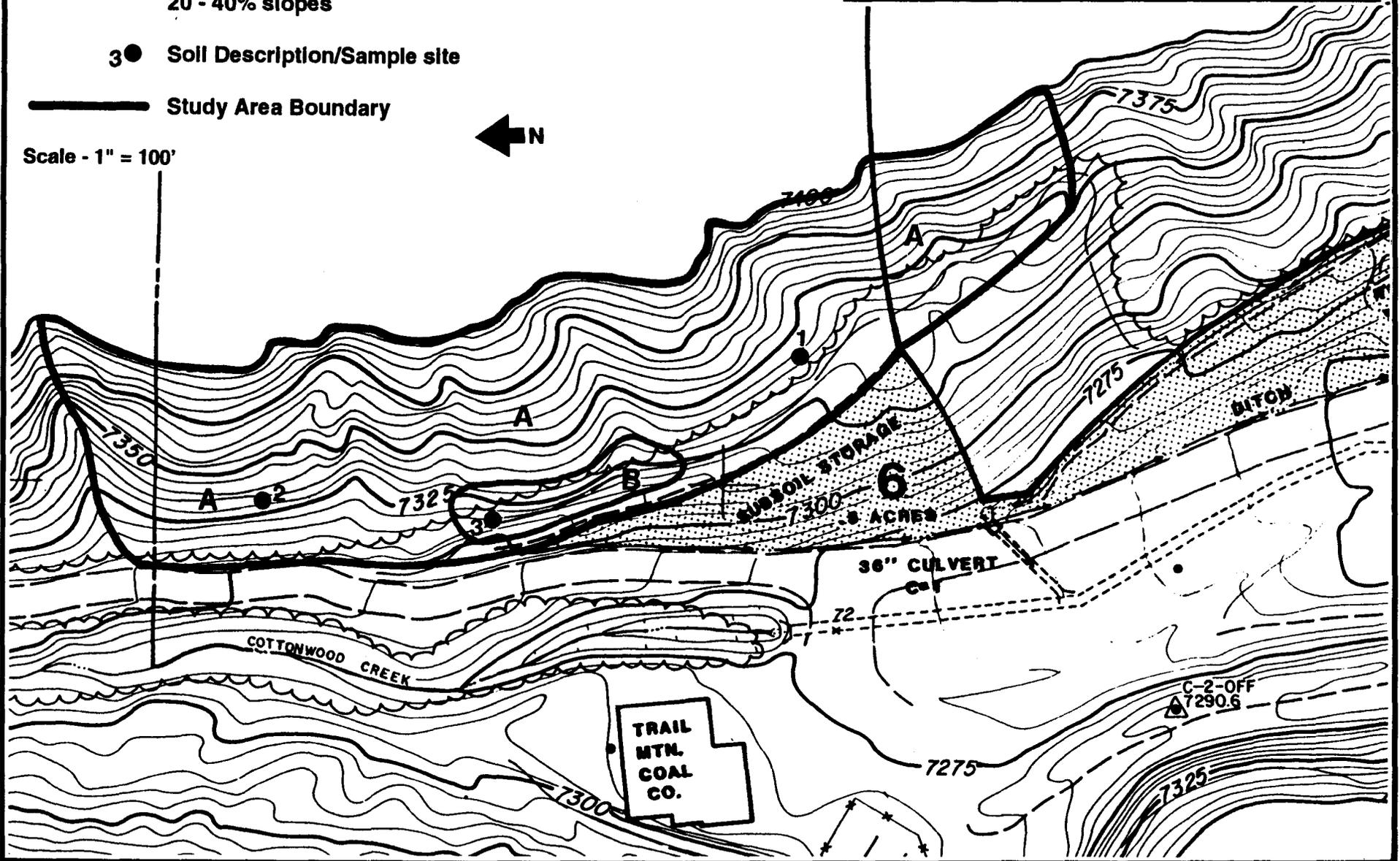
Study Area Boundary

Scale - 1" = 100'



**COTTONWOOD/TRAIL MTN. PORTAL AREA  
TRAIL MOUNTAIN MINE  
PACIFICORP, HUNTINGTON, UTAH**

**SOIL MAP T**



## **APPENDIX B**

### **Soil Profile/Landscape Photographs**







TM-3 Colluvial Fan Landscape

**APPENDIX C**

**Soil Laboratory Results**

Jim Nyenhuis  
Professional Soil Scientist

Proposed East Portal Area  
Trail Mountain Mine  
Huntington, Utah

Colorado State University  
Soil, Water & Plant Testing Laboratory  
Room 6, Vocational Education Building  
Fort Collins, CO 80523  
303-491-5061  
DATE: 12/16/93  
BILLING:

For: Rick Collins  
Mount Nebo Scientific  
330 E 400 S Ste 6 - Box 337  
Springville, UT 84663

DATE RECEIVED: 11/01/93  
Page 1 of 3

RESEARCH SOIL ANALYSIS

Lab #	Sample ID #	mmhos/cm -----meq/l-----							% -----mg/l-----			
		---Paste---		Ca	Mg	Na	K	SAR	SAT	CO <sub>3</sub>	HCO <sub>3</sub>	Alkalinity
		pH	E.C.									
R2603	TM-1 0-3"	8.2	0.6	2.8	2.2	0.8	1.3	0.5	37.1	<0.1	327.0	272.5
R2604	TM-2 0-5"	7.9	0.6	4.8	1.4	0.5	0.3	0.3	46.7	<0.1	375.8	313.2
R2605	TM-3 0-6"	8.2	0.9	4.0	2.0	3.2	1.0	1.8	31.4	<0.1	328.2	273.5
R2606	TM-3 6-30"	8.2	1.4	3.8	3.0	7.3	1.5	3.9	27.1	<0.1	323.3	269.4
R2607	TM-3 30-48"	8.1	8.7	15.0	82.2	46.5	1.3	6.7	33.2	<0.1	260.5	217.1
R2608	TM-3 48-68"	8.2	24.6	21.0	33.7	18.6	1.6	3.6	27.5	<0.1	253.2	211.0
<u>Duplicates</u>												
R2604d	TM-2 0-5"									<0.1	377.0	314.2
R2605d	TM-3 0-6"	8.2	0.9	4.4	2.1	3.3	1.1	1.9	34.4	<0.1	326.4	272.0

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Page 2 of 3

RESEARCH SOIL ANALYSIS

Lab #	Sample ID #	-----%-----					Texture	-----%-----			% Total Kjeldahl N	mg/kg NaHCO <sub>3</sub> Olsen's P
		equivalent CaCO <sub>3</sub>	TOC	Sand	Silt	Clay		*Coarse Fragments Gravels (2mm-3")	Cobbles (3-10")	Stones, Boulders (>10")		
R2603	TM-1 0-3"	43.4	1.97	8	52	40	Silt Clay/Silt Clay Loam	30	0	0	0.072	1.8
R2604	TM-2 0-5"	12.5	2.79	77	16	7	Loamy Sandy/Sandy Loam	15	20	5	0.185	3.7
R2605	TM-3 0-6"	23.8	1.54	68	22	10	Sandy Loam	15	10	10	0.107	3.2
R2606	TM-3 6-30"	17.9	1.02	68	19	13	Sandy Loam	15	10	10	0.051	<1.0
R2607	TM-3 30-48"	17.3	0.73	63	23	14	Sandy Loam	25	10	10	0.044	1.4
R2608	TM-3 48-68"	35.0	0.85	52	30	18	Loam/Sandy Loam	25	10	10	0.046	1.3
<u>Duplicates</u>												
R2604d	TM-2 0-5"	10.4	2.98	78	15	7	Loamy Sand				0.191	2.2
R2605d	TM-3 0-6"											

\*Coarse Fragments: Percent by volume determined by screening

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RESEARCH SOIL ANALYSIS

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Lab #	Sample ID #	-----% H <sub>2</sub> O-----		Available Water Capacity	g/cm <sup>3</sup> Bulk Density
		1/3 Bar	15 Bar		
R2603	TM-1 0-3"	22.8	10.0	12.8	1.4
R2604	TM-2 0-5"	16.6	11.5	5.1	1.3
R2605	TM-3 0-6"	12.3	7.0	5.3	1.4
R2606	TM-3 6-30"	10.3	5.7	4.6	1.4
R2607	TM-3 30-48"	11.7	6.1	5.6	1.4
R2608	TM-3 48-68"	20.4	9.6	10.8	1.3
<u>Duplicates</u>					
R2604d	TM-2 0-5"	17.2	11.3	5.9	1.3
R2605d	TM-3 0-6"				

# **CONSTRUCTION MAPS**