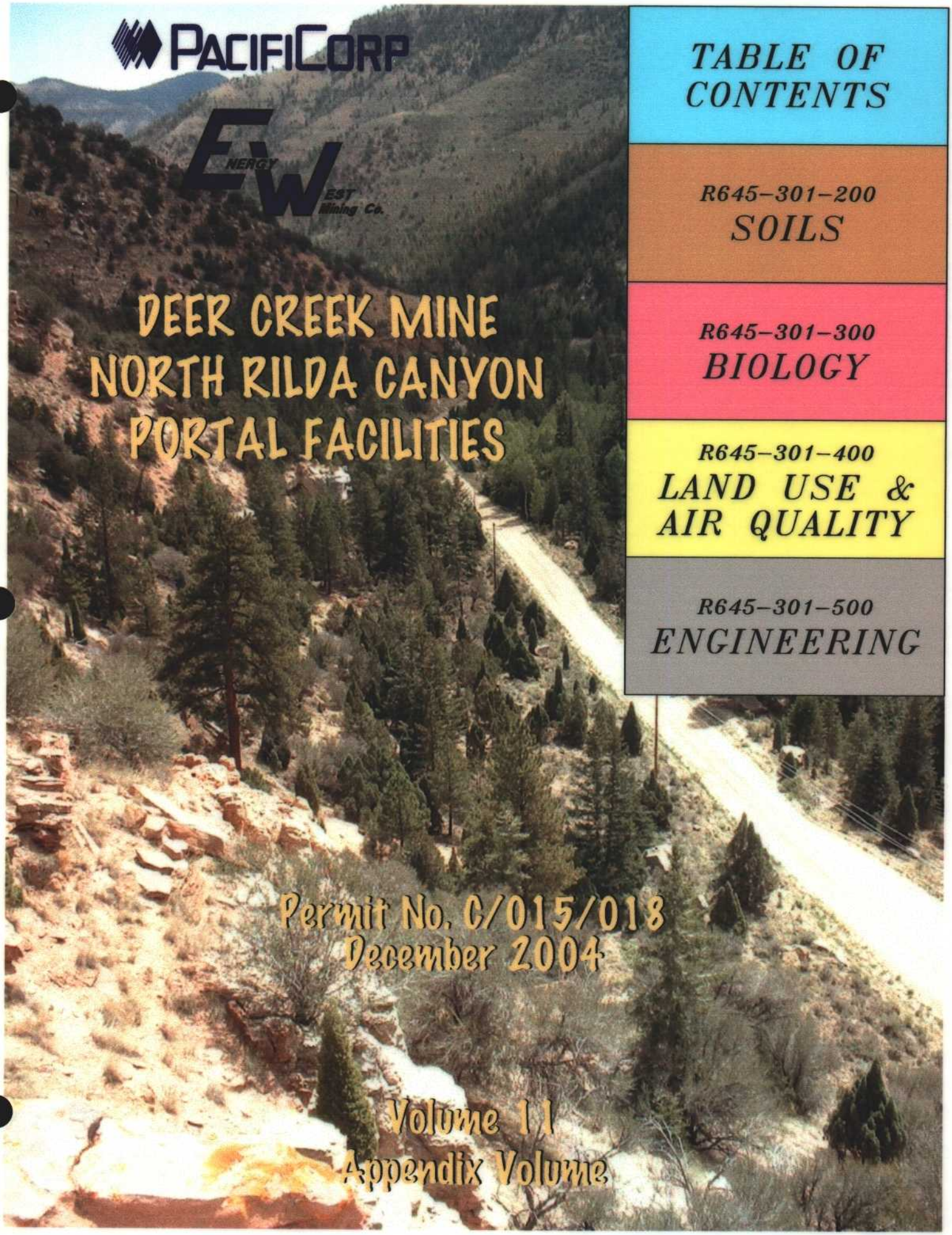

PACIFICORP

ENERGY WEST Mining Co.

DEER CREEK MINE
NORTH RILDA CANYON
PORTAL FACILITIES

Permit No. C/015/018
December 2004

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APPENDIX A

♦ SOIL INVENTORY AND ASSESSMENT
RILDA CANYON PORTAL AND FACILITIES SITE
DEER CREEK MINE

EIS ENVIRONMENTAL AND CONSULTING

MAY 2004

Soil Inventory and Assessment

Rilda Canyon Portal and Facilities Site
Deer Creek Mine

For:

Energy West Mining Company
P.O. Box 310
Huntington, Utah 84528

By:

EIS Environmental and Engineering Consulting
31 North Main Street
Helper, Utah 84526

May 2004

Soil Inventory and Assessment
Rilda Canyon Portal and Facilities Site
Deer Creek Mine

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   6.5 Soil and Site Photographs

Soil Inventory and Assessment
Rilda Canyon Portal and Facilities Site
Deer Creek Mine

1. Introduction

This soils information was compiled to aid in the development and reclamation associated with a proposed coal mine portal and facilities site in Rilda Canyon, Emery County, Utah (Section 28, T16S, R7E). The project links to the mine development of the Deer Creek Mine operated by Energy West Mining Company, Huntington, Utah.

The site is located in a steep, rocky canyon with a narrow bottomland. Several old coal mines were in the area and have been mostly reclaimed. Much of the proposed project would be on lands previously disturbed by mining activities and road construction.

The total surface area involved in this portal project is about 11 acres.

An initial site visit to the project area to evaluate the soils situation and discuss information needs was conducted on August 21, 2003. Those participating were Charles Semborski, Dennis Oakley and Kerry Larsen of Energy West Mining Company; Priscilla Burton (Utah Division of Oil, Gas & Mining); and Dan Larsen (EIS).

This inventory and assessment was conducted primarily by Dan Larsen, Soil Scientist, EIS, Helper, Utah. Dennis Oakley, Energy West Mining Co., assisted with soil sampling and submitted soil samples to Inter-Mountain Laboratories, Inc. for analysis. Kerry Larsen (EWMC) also assisted with soil sampling and locating soil description points (GPS). Dee Ann Kennick, Katie Nash and Rick Riche of EIS assisted with report preparation and map work.

2. Procedures

Soil inventory fieldwork was conducted on September 4, 2003 with additional information collected from 15 geotechnical study pits on April 12 & 13, 2004. Soils data was obtained by the use of a trackhoe to dig several soil pits, a spade and a hand soil auger. Soils were inspected at representative locations throughout the project area. In addition to digging to expose soils, observations were made of cut slopes along roads and of materials existing at the surface. Surface land features and vegetation were noted as appropriate to correlate to soils.

Arrangements were made with Sinbad Construction Co., Inc. to dig soil pits with their trackhoe since they had the equipment near the site working on a waterline for the North Emery Water Users Association. Two soil pits were dug in disturbed soil materials below the old Leroy Mine. Another pit that had been dug for NEWUA just west of the portal project area was also used for a soil description in the alluvial valley bottom. The 15 pits

dug for geotechnical studies were excavated by Nelco Contractors, Inc. Soil descriptions and notes were recorded on USDA soil description forms (SCS-Soils-232G). File notations were identified as R (Rilda), S (Soils) and the description or stop number. Description R-S1 was the first description taken. Notes from geotechnical study pits were designated as G-1 through G-15. Field soils descriptions and notes are presented in Appendix 6.4

Samples of representative soils were collected in one gallon sized plastic recloseable bags. Twelve samples were selected and submitted to Inter-Mountain Laboratories, Inc., Sheridan, Wyoming for analysis of a variety of parameters as recommended by the Utah State Division of Oil, Gas & Mining. The laboratory soil analysis report is in Appendix 6.2.

Representative photographs of the site and soil conditions are presented in Appendix 6.5.

3. Soil Resources

3.1 General

The soils in the project area have formed mostly from sandstone and shale parent materials in a steeply sloping canyon with a narrow bottomland at about 7450 to 7725 feet in elevation. The main slope has a south aspect and supports a general pinyon/juniper vegetation type. Rock outcrops and weakly developed stony, calcareous soils are typical along this slope. The bottomland has very deep alluvial soils that support a variety of plants including willows, dogwood, Englemann spruce and cottonwood. The north facing slopes above the bottomland along the south edge of the project area have shallow to deep stony soils with moderately thick dark colored surface layers. Douglas fir and aspen are common plant species. Soil temperature regimes range from cryic on the north aspects to mesic on the upper portion of the south-facing slope. The toe slope along the road in Rilda Canyon is considered to be in a frigid soil temperature regime. The three temperature regimes were documented in soil temperature monitoring studies conducted in Rilda Canyon by the Forest Service.

Much of the land surface has already been disturbed by previous mining activities and consists of mixed soil materials and waste coal.

Typical soils of the site would be of, or similar to, the following soil series and families: Pathead, Podo, Strych, Brycan and Winetti.

3.2 Soil Map Units and Soils Map

Eight soil map units were identified based on soil and landscape features. Their distribution within the area is shown as delineated on the soils map in Appendix 6.1.

Reference to soil colors in the following map unit descriptions is for a moist condition.

Soil Map Unit A

This soil map unit consists of the alluvial bottomland soils south of the main road along Rilda Creek. The soils are very deep and moderately well to somewhat poorly drained. Soil texture is predominantly sandy loam. A dark colored surface layer (ranging from 10 YR 2/1 to 10 YR 3/3) is commonly 16 to 24 inches thick. Subsoils are brown to dark yellowish brown and commonly have patches (mottling) of strong brown and light yellowish brown. Soil mottling, which indicates a periodic high water table, commonly starts at a depth of 18 to 30 inches. Rock fragment content is low in the surface and increases to about 20 percent in the subsoil.

Soil Map Unit B

This soil map unit consists of very steep, well drained, rocky slopes. Aspect is generally to the south and vegetation is dominantly a pinyon/juniper type. Sandstone rock outcrops and boulders are common and the surface is very stony. Soils range from shallow over bedrock to very deep in stony colluvial materials. Soils are weakly developed and high in carbonates. Dark colored surface soils are generally less than five inches thick. Subsoils are typically very cobbly to very stony and have a yellowish brown to brown color, sandy loam to loam textures and high carbonates (20−33%).

Soil Map Unit C

This map unit consists of stony to cobbly soils on toe slopes and fans. The materials are derived mostly from sandstone and include colluvial and alluvial deposits. They are well drained and have slopes of about 15 to 35 percent. Soil texture is dominantly sandy loam. Topsoil layers are thin to moderately thick and subsoils are high in carbonates. Vegetation includes pinyon, juniper, ponderosa pine and mountain mahogany. The soils are of and similar to the Strych soil series. Surface stones and boulders affect the suitability as topsoil. This unit grades into Soil Map Unit B without a distinct boundary between the two units.

Soil Map Unit D

The soils in this map unit have been disturbed by previous mining activities and road construction. They consist of mixed soil materials and waste coal. In the area that had been reclaimed below the old Leroy Mine, two soil pits (R-52 and R-53) revealed a layer of about one to two feet of cobbly sandy loam soil over waste coal materials.

The coal deposits are up to eight feet in depth. Also included in the unit are some fill and sidecast materials along the main road. These soils are intersparsed with patches of waste coal.

Soil Map Unit DR

This unit designates the narrow access roads leading to old mines. The main section leads from the Rilda Canyon road to the Leroy Mine portal site where a fan breakout is proposed. This is a single track road cut through Soil Map Unit B on a steep, rocky, south facing slope. The surface of the old road consists of gravely to stony soil materials derived mostly from sloughing and erosion of the cut slope and subsoil in the road base. Soil textures are mostly sandy loam with intrusions of loam. The materials in the upper 8 to 24 inches show good rooting potential. Underlying materials are very stony.

Soil Map Unit DF

This is a bench and cut slope at the old Leroy Mine site where a ventilation fan is proposed for this project. It includes a relatively flat area which has very little soil material over sandstone bedrock and a cut slope having poor quality soil materials. Soil sample, RIL1303, site R-S5 was taken from the cutslope to characterize the soil materials at this location.

Soil Map Unit RD

This is a miscellaneous unit that consists of the present road in Rilda Canyon. It was not evaluated as a soil resource.

Additional Note: Soils were checked on the steep north facing slopes south of the project area above the alluvial bottomland. The area may not be involved in the project development but is mentioned for reference. General vegetation consists of a Douglas-fir type with some aspen. The soils are mostly developed in stony colluvial materials; however, there are some spots where sandstone bedrock is at or near the surface. Surface soils are typically dark colored sandy loam to loam ranging from about 10 to 18 inches thick. Subsoils are brown stony sandy loam and loam. The soils are well drained and have slopes of about 40 to 60 percent.

Soil Map Unit SC

This unit designates the approximate stream cut and channel along Rilda Creek. The soils along the edge of this unit are primarily deep alluvial soils of Soil Map Unit A. The stream channel width was not mapped in detail, but was delineated with an average width of about 20 feet. This area would not be considered for soil salvage since it would be a site that would need to be filled in.

4. Soil Testing Results and Suitability Assessment

Results of soil testing are presented in Appendix 6.2. The soil sample identification corresponds to the following soil samples by description number and soil depth.

Sample ID	Site	Depth Interval	Location
RIL0103	R-S1	0 - 12 inches	Alluvial Bottomland
RIL0203	R-S1	12 - 18 inches	Alluvial Bottomland
RIL0303	R-S1	24 - 40 inches	Alluvial Bottomland
RIL0403	R-S2	0 - 12 inches	Disturbed Area
RIL0503	R-S2	12 - 18 inches	Disturbed Area
RIL0703	R-S2	60 - 72 inches	Disturbed Area
RIL0803	R-S3	0 - 10 inches	Disturbed Area
RIL1003	R-S3	80 - 96 inches	Disturbed Area
RIL1103	R-S4	0 - 7 inches	Alluvial Bottomland
RIL1203	R-S4	7 - 24 inches	Alluvial Bottomland
RIL1303	R-S5	0 - 8 inches	Fan Site, Cutslope
RIL1403	R-S6	0 - 8 inches	Access Road to fan site

Soil suitability guides are given in Appendix 6.3. Surface soils along the alluvial valley bottom (Map Unit A) would have a rating of "good" for suitability as topsoil. Soils along the south-facing slope would rate "fair" to "poor". The disturbed soils along the access road to the old Leroy Mine and the reclaimed sites below the Leroy Mine and Rominger Mine would rate as "fair" to "poor" with the waste coal material being unsuitable as topsoil. The low suitability ratings are due to the high carbonate content, high amount of rock fragments and general low nutrient status. All soils rated "good" in respect to pH, EC, SAR, texture, selenium, boron and acid/base potential. K-factors are estimated at about .20 to .32 which would be "fair" to "good" in regards to soil erodibility.

5. Soil Salvage

Soil salvage would include soil materials ranging from "good" to "poor" in suitability for plant growth. The intent would be to salvage as much soil as possible to assure successful reclamation of the project area. This inventory provides a guide to soil salvage, however, adjustments may be needed as the materials are excavated due to soil variability

Estimates of available soil suitable for salvage are given in Table 5A. This includes all of the area within the proposed boundary of disturbance for the project. Actual salvage will depend upon the total amount of excavation needed. Some sites, such as the soil stockpile location, would not need to have the surface soil removed. Adjustments would also be needed for the stream. Topsoil from the bottomland (Unit A) has the best suitability rating

and it is recommended to segregate this soil from the soil of lower suitability from the south facing slope and previously disturbed sites. Although much of the surface soil is of fair to poor quality based on evaluation criteria, it represents the most suitable soil materials found in the natural environment of the pinyon-juniper type on these rocky canyon slopes. Soils considered for potential salvage are not necessarily of a quality typically thought of as topsoil. They are also higher in rock fragment content than would be acceptable for typical topsoils.

Table 5A
Estimated Salvageable Soils
Approximate Salvage Depths and Volumes
Rilda Canyon Portal Project

Soil Map Unit	Suitability Rating	Approx. Thickness (In.)	Area (Acres)	Volume (Cubic Yards)
A	Good	12 to 24; Ave. 18	3.34	8082
B	Fair to Poor	4 to 8; Ave. 6	1.57	1266
C	Fair	6 to 12; Ave. 8	1.12	1205
D	Fair (Some poor & good)	6 to 18; Ave. 12	3.33	5372
DR	Fair to Poor	6 to 20; Ave. 8	0.37	398
DF, RD, SC	Not considered as a source of soil for salvage			

This table represents what is considered to be suitable soil materials for reclamation. It gives the estimate amount of available soils but is not intended to show the actual amount of soil to be salvaged. Actual amounts will depend on detailed site planning and construction. Unit A was rated as "good" although the water holding capacity was slightly low based on laboratory testing. Very little soil would be available in Unit DF at the proposed fan site. Unit DF was not considered in volume estimates, nor was the existing road (RD) or the stream channel (SC). Volume estimates were calculated based on 134.44 cubic yards per inch of soil thickness per acre.

Soil Inventory and Assessment

Rilda Canyon Portal and Facilities Site
Deer Creek Mine

Appendices

6.1	Soils Map
6.2	Soil Testing Data
6.3	Soil Suitability Guidelines
6.4	Soil Field Descriptions and Notes
6.5	Soil and Site Photographs

Appendix 6.1

Soils Map

Rilda Canyon Portal and Facilities Site
Deer Creek Mine

Appendix 6.2

Soil Testing Data

Rilda Canyon Portal and Facilities Site
Deer Creek Mine

Inter-Mountain Laboratories, Inc.

1633 Terra Avenue
Sheridan, WY 82801

Report ID: 010313804

Soil Analysis Report

Energy West Mining Co.
P.O. Box 310
Huntington, UT 84528

Client Project ID: Rilda Canyon
Date Received: 09/11/03

Set #0103S13804
Report Date: 10/02/03

Lab Id	Sample Id	Site	Depth	pH	Saturation	EC @ 25°C	Calcium	Magnesium	Sodium	Potassium	SAR
				s.u.	%	mmhos/cm	meq/L	meq/L	meq/L	meq/L	
03S13804	RIL0103	1	0-12"	7.3	33.2	0.48	2.91	1.48	0.92	0.37	0.62
03S13805	RIL0203	1	12-18	7.4	34.0	0.45	2.80	2.00	1.03	0.15	0.66
03S13806	RIL0303	1	24-40	7.4	34.9	0.32	1.31	1.02	1.59	0.13	1.47
03S13807	RIL0403	2	0-12	7.3	28.1	0.33	2.23	1.16	0.84	0.12	0.65
03S13808	RIL0503	2	12-18	7.2	24.9	0.36	2.02	1.51	0.92	0.12	0.69
03S13809	RIL0703	2	60-72	7.2	25.8	0.74	5.41	2.07	0.94	0.10	0.49
03S13810	RIL0803	3	0-10	7.4	32.4	0.37	1.92	1.25	0.97	0.16	0.77
03S13811	RIL1003	3	80-96 coal	7.2	39.4	1.23	5.79	10.8	1.68	0.14	0.58
03S13812	RIL1103	4	0-7	7.1	55.3	0.46	3.33	0.96	0.91	0.63	0.62
03S13813	RIL1203	4	7-24	7.3	34.6	0.38	2.58	0.82	0.77	0.35	0.59
03S13814	RIL1303	5	0-8	7.4	24.4	0.65	2.64	3.39	1.04	0.43	0.60
03S13815	RIL1403	6	0-8	7.4	27.7	0.46	3.37	1.28	0.76	0.34	0.50

hese results only apply to the samples tested.

bbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
bbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neut. Pot.= Neutralization Potential
liscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

leviewed By: _____
Joey Sheeley, Soils Lab Supervisor

Inter-Mountain Laboratories, Inc.

1633 Terra Avenue
Sheridan, WY 82801

Report ID: 010313804

Soil Analysis Report

Energy West Mining Co.
P.O. Box 310
Huntington, UT 84528

Client Project ID: Rilda Canyon
Date Received: 09/11/03

Set #0103S13804
Report Date: 10/02/03

Lab Id	Sample Id	Site	Depth	Coarse Fragments %	Field Capacity %	Wilt Point %	Dry Color	Sand %	Silt %	Clay %	Texture
103S13804	RIL0103	1	0-12"	1.1	16.5	9.9	10YR 4/2	56.0	28.0	16.0	SANDY LOAM
103S13805	RIL0203	1	12-18	7.3	16.6	11.4	10YR 5/2	53.0	28.0	19.0	SANDY LOAM
103S13806	RIL0303	1	24-40	0.0	18.4	12.2	2.5Y 6/3	41.0	33.0	26.0	LOAM
103S13807	RIL0403	2	0-12	21.0	15.6	7.8	10YR 5/3	58.0	26.0	16.0	SANDY LOAM
103S13808	RIL0503	2	12-18	20.2	14.4	7.9	10YR 5/3	58.0	26.0	16.0	SANDY LOAM
103S13809	RIL0703	2	60-72	21.4	12.9	5.6	10YR 4/3	70.0	17.0	13.0	SANDY LOAM
103S13810	RIL0803	3	0-10	29.7	17.6	10.1	10YR 5/2	58.0	26.0	16.0	SANDY LOAM
103S13811	RIL1003	3	80-96 coal	28.6	19.3	13.2	10YR 2/1	57.0	26.0	17.0	SANDY LOAM
103S13812	RIL1103	4	0-7	1.4	22.1	16.0	10YR 3/2	52.0	33.0	15.0	SANDY LOAM
103S13813	RIL1203	4	7-24	3.5	17.1	11.6	10YR 5/2	48.0	32.0	20.0	LOAM
103S13814	RIL1303	5	0-8	71.1	12.7	8.1	10YR 6/3	38.0	42.0	20.0	LOAM
103S13815	RIL1403	6	0-8	16.2	13.4	7.1	10YR 5/4	56.0	29.0	15.0	SANDY LOAM

These results only apply to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neut. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed By: _____
Joey Sheeley, Soils Lab Supervisor

Inter-Mountain Laboratories, Inc.

Report ID: 010313804

1633 Terra Avenue
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Soil Analysis Report

Energy West Mining Co.
P.O. Box 310
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Lab Id	Sample Id	Site	Depth	TOC	Total Sulfur	T.S. AB	Neutral. Pot.	T.S. ABP	Alkalinity PE	Boron	Nitrogen Nitrate	TKN	Phosphorus	Selenium
				%	%	t/1000t	t/1000t	t/1000t	meq/l	ppm	ppm	%	ppm	ppm
03S13804	RIL0103	1	0-12"	3.2					4.38			0.15	2.66	
03S13805	RIL0203	1	12-18	3.0					3.84			0.11	0.96	
03S13806	RIL0303	1	24-40	0.3					2.73			0.05	0.29	
03S13807	RIL0403	2	0-12	5.1	0.02	0.62	315	314	2.96	0.53	1.30	0.15	1.03	<0.02
03S13808	RIL0503	2	12-18	1.6	<0.01	0.00	346	346	3.15	0.55	0.66	0.06	0.56	<0.02
03S13809	RIL0703	2	60-72	3.7	<0.01	0.00	198	198	2.34	0.68	9.14	0.09	1.23	<0.02
03S13810	RIL0803	3	0-10	4.9	0.03	0.94	277	276	2.92	0.42	1.04	0.12	0.41	<0.02
03S13811	RIL1003	3	80-96 coal	39.8	0.28	8.75	183	174	2.46	1.66	0.68	0.62	1.30	0.04
03S13812	RIL1103	4	0-7	8.5	0.04	1.25	198	197	4.22	0.81	5.42	0.38	2.64	<0.02
03S13813	RIL1203	4	7-24	2.1	0.01	0.31	295	295	3.46	0.47	1.34	0.12	1.18	<0.02
03S13814	RIL1303	5	0-8	0.2	<0.01	0.00	353	353	1.94	0.40	4.94	0.03	0.37	<0.02
03S13815	RIL1403	6	0-8	1.7	0.01	0.31	349	349	4.26	0.33	4.04	0.08	1.58	<0.02

These results only apply to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
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Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed By: _____
Joey Sheeley, Soils Lab Supervisor

Inter-Mountain Laboratories, Inc.

1633 Terra Avenue
Sheridan, WY 82801

Report ID: 010313804

Soil Analysis Report

Energy West Mining Co.
P.O. Box 310
Huntington, UT 84528

Client Project ID: Rilda Canyon
Date Received: 09/11/03

Set #0103S13804
Report Date: 10/02/03

Lab Id	Sample Id	Site	Depth	CO3 %	
03S13804	RIL0103	1	0-12"	18.5	
03S13805	RIL0203	1	12-18	19.9	
03S13806	RIL0303	1	24-40	25.9	
03S13807	RIL0403	2	0-12	28.9	
03S13808	RIL0503	2	12-18	31.2	
03S13809	RIL0703	2	60-72	18.2	
03S13810	RIL0803	3	0-10	25.9	
03S13811	RIL1003	3	80-96 Coal	15.4	
03S13812	RIL1103	4	0-7	18.2	
03S13813	RIL1203	4	7-24	25.7	
03S13814	RIL1303	5	0-8	33.1	
03S13815	RIL1403	6	0-8	0.0	Zero

These results only apply to the samples tested.

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Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed By: _____
Joey Sheeley, Soils Lab Supervisor

Inter-Mountain Laboratories, Inc.

1633 Terra Avenue
Sheridan, WY 82801

Report ID: 010313804

Soil Analysis Report

Energy West Mining Co.
P.O. Box 310
Huntington, UT 84528

Client Project ID: Rilda Canyon
Date Received: 09/11/03

Set #0103S13804
Report Date: 10/02/03

Lab Id	Sample Id	pH	Saturation	EC @ 25°C	Calcium	Magnesium	Sodium	Potassium	SAR
		s.u.	%	mmhos/cm	meq/L	meq/L	meq/L	meq/L	
03S13812	RIL1103	7.1	55.3	0.46	3.33	0.96	0.91	0.63	0.62
03S13812D	RIL1103	7.1	56.0	0.49	4.11	0.95	0.60	0.67	0.38

ese results only apply to the samples tested.

breviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
breviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neut. Pot.= Neutralization Potential
iscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

eviewed By: _____
Joey Sheeley, Soils Lab Supervisor

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Lab Id	Sample Id	Coarse Fragments %	Field Capacity %	Wilt Point %	Color	Sand %	Silt %	Clay %	Texture
03S13812	RIL1103	1.4	22.1	16.0	10YR 3/2	52.0	33.0	15.0	SANDY LOAM
03S13812D	RIL1103		22.6	15.4		52.0	33.0	15.0	SANDY LOAM

These results only apply to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neut. Pot.= Neutralization Potential
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Lab Id	Sample Id	TOC	Total Sulfur	T.S. AB	Neutral. Pot.	T.S. ABP	Alkalinity PE	Boron	Nitrogen Nitrate	TKN	Phosphorus	Selenium
		%	%	t/1000t	t/1000t	t/1000t	meq/l	ppm	ppm	%	ppm	ppm
03S13812	RIL1103	8.5	0.04	1.25	198	197	4.22	0.81	5.42	0.38	2.64	<0.02
03S13812D	RIL1103	7.9	0.04	1.25	197	196	4.19	0.73	5.14	0.37	2.61	<0.02

These results only apply to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neut. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Absorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

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Client Project ID: Rilda Canyon
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Set #0103S13804
Report Date: 10/02/03

Lab Id	Sample Id	CO3 %
03S13812	RIL1103	18.2
03S13812D	RIL1103	18.0

These results only apply to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H2OSol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neut. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed By: _____
Joey Sheeley, Soils Lab Supervisor

Appendix 6.3

Soil Suitability Guidelines

Rilda Canyon Portal and Facilities Site
Deer Creek Mine

**Soil Suitability for Topsoil Evaluation

Parameters	Good	Fair	Poor	Unacceptable
pH	6.1 - 8.2	5.1 – 6.1 8.2 – 8.4	4.5 – 5.0 8.5 – 9.0	less than 4.5 greater than 9.0
EC mmhos/cm 25° C	0 – 2	2 - 8	8 - /5	greater than 15
Saturation %	25% - 80%		less than 25% greater than 80%	
Texture	sl, l, sil, scl, vfsl, fsl	cl, sicl, sc, ls, lfs	sic, s, sc, c, cos, fs, vfs	g, vcos
SAR	0 - 5	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	greater then –5 tons CaCo3 1,000 tons material			less than –5 tons CaCo3 1,000 tons material
% Coal Fine (Total Organic Carbon)	<10%			>10%
Available water capacity (in/in)	Greater than 0.10	0.05 – 0.10	less than 0.05	
Rock Fragments (% volumes) 3 inches 3-10 inches 10 inches	 0 - 15 0 - 15 0 - 3	 15 - 25 15 – 25 3 - 7	 25 - 30 25 - 30 7 – 10	 greater than 30 greater than 30 greater than 10
Carbonates %	<15	15 - 30	>30	
Erodibility K-factor	<0.37		>0.37	

02/25/02

**Revised table prepared by D. Larsen, EIS, based on Utah State Division of Oil, Gas and Mining Guidelines. Tentative guidelines, pending UDOGM revised soil management guidelines. (of 1988)

Inter-Mountain Laboratories, Inc.

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Sheridan, WY 82801

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Energy West Mining Co.
P.O. Box 310
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With Soil Suitability Rating Notes DRK

Client Project ID: Rilda Canyon
Date Received: 09/11/03

Set #0103S13804
Report Date: 10/02/03

Lab Id	Sample Id	Site	Depth	pH	Saturation	EC @ 25°C	Calcium	Magnesium	Sodium	Potassium	SAR
				s.u.	%	mmhos/cm	meq/L	meq/L	meq/L	meq/L	
03S13804	RIL0103	1	0-12"	7.3 G	33.2 G	0.48 G	2.91	1.48	0.92	0.37	0.62 G
03S13805	RIL0203	1	12-18	7.4 G	34.0 G	0.45 G	2.80	2.00	1.03	0.15	0.66 G
03S13806	RIL0303	1	24-40	7.4 G	34.9 G	0.32 G	1.31	1.02	1.59	0.13	1.47 G
03S13807	RIL0403	2	0-12	7.3 G	28.1 G	0.33 G	2.23	1.16	0.84	0.12	0.65 G
03S13808	RIL0503	2	12-18	7.2 G	24.9 F	0.36 G	2.02	1.51	0.92	0.12	0.69 G
03S13809	RIL0703	2	60-72	7.2 G	25.8 G	0.74 G	5.41	2.07	0.94	0.10	0.49 G
03S13810	RIL0803	3	0-10	7.4 G	32.4 G	0.37 G	1.92	1.25	0.97	0.16	0.77 G
03S13811	RIL1003	3	80-96 coal	7.2 G	39.4 G	1.23 G	5.79	10.8	1.68	0.14	0.58 G
03S13812	RIL1103	4	0-7	7.1 G	55.3 G	0.46 G	3.33	0.96	0.91	0.63	0.62 G
03S13813	RIL1203	4	7-24	7.3 G	34.6 G	0.38 G	2.58	0.82	0.77	0.35	0.59 G
03S13814	RIL1303	5	0-8	7.4 G	24.4 P-F	0.65 G	2.64	3.39	1.04	0.43	0.60 G
03S13815	RIL1403	6	0-8	7.4 G	27.7 G	0.46 G	3.37	1.28	0.76	0.34	0.50 G

G - Good
F - Fair
P - Poor
U - Unacceptable

hese results only apply to the samples tested.

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bbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neut. Pot.= Neutralization Potential
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Joey Sheeley, Soils Lab Supervisor

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With Suitability Rating Notes

1633 Terra Avenue
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Set #0103S13804
Report Date: 10/02/03

Lab Id	Sample Id	Site	Depth	Coarse Fragments %	Field Capacity %	Avail. Wilt Point in/in	%		Dry Color	Sand %	Silt %	Clay %	Texture	
103S13804	RIL0103	1	0-12"	1.1	16.5	.066	9.9	F	10YR 4/2	56.0	28.0	16.0	SANDY LOAM	G
103S13805	RIL0203	1	12-18	7.3	16.6	.058	11.4	F	10YR 5/2	53.0	28.0	19.0	SANDY LOAM	G
103S13806	RIL0303	1	24-40	0.0	18.4	.062	12.2	F	2.5Y 6/3	41.0	33.0	26.0	LOAM	G
103S13807	RIL0403	2	0-12	21.0	15.6	.078	7.8	F	10YR 5/3	58.0	26.0	16.0	SANDY LOAM	G
103S13808	RIL0503	2	12-18	20.2	14.4	.065	7.9	F	10YR 5/3	58.0	26.0	16.0	SANDY LOAM	G
103S13809	RIL0703	2	60-72	21.4	12.9	.073	5.6	F	10YR 4/3	70.0	17.0	13.0	SANDY LOAM	G
103S13810	RIL0803	3	0-10	29.7	17.6	.075	10.1	F	10YR 5/2	58.0	26.0	16.0	SANDY LOAM	G
103S13811	RIL1003	3	80-96 coal	28.6	19.3	.061	13.2	F	10YR 2/1	57.0	26.0	17.0	SANDY LOAM	G
103S13812	RIL1103	4	0-7	1.4	22.1	.061	16.0	F	10YR 3/2	52.0	33.0	15.0	SANDY LOAM	G
103S13813	RIL1203	4	7-24	3.5	17.1	.055	11.6	F	10YR 5/2	48.0	32.0	20.0	LOAM	G
103S13814	RIL1303	5	0-8	71.1	12.7	.046	8.1	P	10YR 6/3	38.0	42.0	20.0	LOAM	G
103S13815	RIL1403	6	0-8	16.2	13.4	.063	7.1	F	10YR 5/4	56.0	29.0	15.0	SANDY LOAM	G

>2mm

G - Good
F - Fair
P - Poor
U - Unacceptable

These results only apply to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H2OSol= water soluble, AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
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With Soil Suitability Rating Notes

1633 Terra Avenue
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Client Project ID: Rilda Canyon
Date Received: 09/11/03

Set #0103S13804
Report Date: 10/02/03

Lab Id	Sample Id	Site	Depth	TOC %	Total Sulfur %	T.S. AB mg/kg	Neutral. Pot. mg/kg	T.S. ABP mg/kg	Alkalinity PE mg/kg	Boron ppm	Nitrogen Nitrate ppm	TKN %	Phosphorus ppm	Selenium ppm
03S13804	RIL0103	1	0-12"	3.2					4.38			0.15	2.66	
03S13805	RIL0203	1	12-18	3.0					3.84			0.11	0.96	
03S13806	RIL0303	1	24-40	0.3					2.73			0.05	0.29	
03S13807	RIL0403	2	0-12	5.1	0.02	0.62	315 G	314	2.96	0.53 G	1.30	0.15	1.03	<0.02 G
03S13808	RIL0503	2	12-18	1.6	<0.01	0.00	346 G	346	3.15	0.55 G	0.66	0.06	0.56	<0.02 G
03S13809	RIL0703	2	60-72	3.7	<0.01	0.00	198 G	198	2.34	0.68 G	9.14	0.09	1.23	<0.02 G
03S13810	RIL0803	3	0-10	4.9	0.03	0.94	277 G	276	2.92	0.42 G	1.04	0.12	0.41	<0.02 G
03S13811	RIL1003	3	80-96 coal	39.8 U	0.28	8.75	183 G	174	2.48	1.66 G	0.68	0.62	1.30	0.04 G
03S13812	RIL1103	4	0-7	8.5	0.04	1.25	198 G	197	4.22	0.81 G	5.42	0.38	2.64	<0.02 G
03S13813	RIL1203	4	7-24	2.1	0.01	0.31	295 G	295	3.46	0.47 G	1.34	0.12	1.18	<0.02 G
03S13814	RIL1303	5	0-8	0.2	<0.01	0.00	353 G	353	1.94	0.40 G	4.94	0.03	0.37	<0.02 G
03S13815	RIL1403	6	0-8	1.7	0.01	0.31	349 G	349	4.26	0.33 G	4.04	0.08	1.58	<0.02 G

Good is <10% coal fines (TOC)

> 5 Tons CaCO3 / 1000 Tons material Acid Base Potential is good

< 5.0 is good

< 0.1 is Good

These results only apply to the samples tested.

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Set #0103S13804
Report Date: 10/02/03

Lab Id	Sample Id	Site	Depth	CO3 %	
03S13804	RIL0103	1	0-12"	18.5	F
03S13805	RIL0203	1	12-18	19.9	F
03S13806	RIL0303	1	24-40	25.9	F
03S13807	RIL0403	2	0-12	28.9	F
03S13808	RIL0503	2	12-18	31.2	P
03S13809	RIL0703	2	60-72	18.2	F
03S13810	RIL0803	3	0-10	25.9	F
03S13811	RIL1003	3	80-96 Coal	15.4	F
03S13812	RIL1103	4	0-7	18.2	F
03S13813	RIL1203	4	7-24	25.7	F
03S13814	RIL1303	5	0-8	33.1	P
03S13815	RIL1403	6	0-8	0.0	? - Error in Test

G - Good
F - Fair
P - Poor

These results only apply to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
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Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed By: _____
Joey Sheeley, Soils Lab Supervisor

Appendix 6.4

Soil Description and Field Notes

Rilda Canyon Portal and Facilities Site
Deer Creek Mine

SCS-SOILS-232G

U.S. DEPARTMENT OF AGRICULTURE

Rilda Canyon Portal Project SOIL DESCRIPTION

Soil type Map Unit A - Alluvial Bottomland

File No. R-S1

Area Rilda Canyon | Date 9-4-03 | By: D Larson | Stop No. R 1

Classification

Location S28, T16S, R7E: About 150 yds. west of fence at edge of the project area

N. veg. (or crop) Cottonwood, willow, wild rose, aspen | Climate Cryic - Frigid Udic

Parent material Alluvium from sandstone and shale

Physiography Canyon bottom

Relief Gentle slope	Drainage Moderately well to somewhat poorly	Salt or alkali
Elevation 7555 feet	Gr. water ≈ 8 feet	Stoniness
Slope 8%	Moisture	
Aspect North	Root distrib. Upper 18" - few below	% Clay *
Erosion —	% Coarse fragments *	% Coarser than V.F.S. *

Permeability Moderate

Additional notes North Emery Water Users Assoc. pit for work along pipeline
About 60 feet from the stream
Free water in the bottom of the pit
Mottling begins at about 18 inches

GROUND COVER (%)	RANGE	AVERAGE
Gravel 2MM-3"		
Cobble 3-10"		
Stone 10-24"		
Boulder >24"		
Vegetation		
Litter		
Bare		

Sampled 0-12" A RIL0103
12-18 AB RIL0203
24-40 C RIL0303

* Control section average

Horizon	Depth (inches)	Color Dry	Color Moist	% < 2 Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary	% Rock Fragments	Root Distribution		
O	1/2-0	Decaying leaves and grass												
A1	0-12	10YR 4/2	10YR 2/2 - 2/1 very dark brown	16 SL	MFGR	SO	FR	SS/SP	7.3	CW	5 gr 15 co	mf-m fc		
AB	12-18	10YR 5/2	10YR 3/2 V. dark grayish br.	19 SL-SCL	MASBK	SH	FI	SS/SP	7.4	GW	8 gr 5 co	cf-m		
BC	18-24		10YR 4/3 with patches of 10YR 6/4	26 L	WMSBK	H	FI	S/P	7.4	GW	2 gr 1 co	ff-m		
C1	24-48	mixed color 10YR 5/2 - 5/1, 2.5Y 6/3	10YR 4/4 mixed 10YR 4/3 + 6/6	L-CL	OM	H	FI	S/P	7.3	GW	"			
C2	48-100		7.5YR 5/6 - 5/8 + 6/6 10YR 5/2 + 5/4	L	OM	H	FI	S/P			"			
			10YR 4/6 mixed											

SCS-SOILS-232G

U.S. DEPARTMENT OF AGRICULTURE

SOIL DESCRIPTION

Soil type Map Unit D - Disturbed Soils

File No. R-52

Area Bilda Canyon Emery Co., Utah

Date 9-4-03 By: D. Larsen Stop No. 2

Classification Disturbed land

Location Below The LeRoy Mine, reclaimed slope S28, T16S, R7E

N. veg. (or crop) P-J site

Climate Ustic - Mesic/Frigid

Parent material Sandstone, shale, coal

Physiography Toeslope

Relief Mod steep, single

Drainage Well drained

Salt or alkali

Elevation 7535 feet

Gr. water

Stoniness

Slope 20%

Moisture

Aspect South

Root distrib.

% Clay *

Erosion

% Coarse fragments *

% Coarser than V.F.S. *

Permeability Moderate

Additional notes

Soil Samples: 0-12" R1L0403
12-18" R1L0503
18-58" R1L0603
60-72" R1L0703

GROUND COVER (%)	RANGE	AVERAGE
Gravel 2MM-3"		30
Cobble 3-10"		20
Stone 10-24"		5
Boulder >24"		
Vegetation		
Litter		
Bare		

* Control section average

Horizon	Depth (inches)	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary	% Rock Fragments	Root Distribution		
Disturbed AC	0-20 18-23" range	10YR 5/3	10YR 4/2	16 SL	WPGR-OM	SO	FR	SS/SP	7.3	aw	30 gr 20 c 2 st	CF-m		
	12-18	Slightly lighter color 10YR 6/3 - 5/3	10YR 4/4 - 4/3	16 SL					7.2			"		
COAL	20-57		5Y 2.5/1 Black		SG-OM		FR			aw		ff		
II AC	57-72		10YR 3/2 - 3/3	13 SL	OM	SH	SFI	SS/SP	7.4	gw	15 10			
C	72-85		10YR 4/4			SH	SFI	SS/SP			25 20 10			

SCS-SOILS-232G

U.S. DEPARTMENT OF AGRICULTURE

SOIL DESCRIPTION

Soil type Map Unit D - Disturbed Soils

File No. R-53

Area Rilda Canyon | Date 9-4-03 | By: D. Larsen | Stop No. 3

Classification Disturbed loamy-skeletal

Location Below old heroy mine, reclaimed site S28, T16S, R7E

N. veg. (or crop) Mixed - Juniper site

Climate Frigid/Mesic Transition Ustic

Parent material Sandstone or shale; colluvium, mixed soil over coal waste

Physiography Toeslope

Relief Mod. steep, simple

Drainage Well drained

Salt or alkali

Elevation 7530

Gr. water

Stoniness

Slope 33%

Moisture

Aspect South

Root distrib. Well distributed in soil & some in coal waste

% Clay * 17%

Erosion Moderate

% Coarse fragments *

% Coarser than V.F.S. *

Permeability Moderate

Additional notes Soil Samples:
0-10" RIL0803
15-50" RIL0903
7-8 feet RIL1003
(7-8 feet)

Mixed soil over waste coal
Didn't get to the total depth of waste coal - Dug to about 8 feet

GROUND COVER (%)	RANGE	AVERAGE
Gravel 2MM-3"		30
Cobble 3-10"		25
Stone 10-24"		15
Boulder >24"		2
Vegetation		3
Litter		5
Bare		30

* Control section average

Horizon	Depth (inches)	Color Dry	Color Moist	Texture % clay	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary	% Rock Fragments	Root Distribution		
Disturbed AC	Range 8-15 0-12	10YR 5/3	Dark grayish brown 10YR 4/2	Sandy loam 16% c			Friable	SS/SP	7.4	CW	30g 20c 5st	common fine + medium cfm		
C1	12-36	waste coal	10YR 2/1 Black	SL			Fr	NS NP		gw	40g 10c	cfm ff	in upper 8 below	
C2	36-100	waste coal and sandstone rock fragments		SL 17% c			Fr		7.2		40g 20c 5st	-		

SCS-SOILS-232G

U.S. DEPARTMENT OF AGRICULTURE

SOIL DESCRIPTION

Soil type Map Unit A – Alluvial bottom land Emery Co., Utah | File No. R-54

Area Rilda Canyon | Date 9-4-03 | By: D. Larsen | Stop No. 4

Classification Fine-loamy, mixed, Cumulic Haplocryoll (or Ustoll)

Location Between road and Rilda Creek, near old tercy mine site S 2 E, T16S, R7E

N. veg. (or crop) Cottonwood, aspen, spruce, maple, oregon grape | Climate Cryic/Frigid Transition Ustic

Parent material Alluvium from sandstone and shale

Physiography. Canyon bottom land

Relief Gently sloping | Drainage Well drained - med. well | Salt or alkali

Elevation 7495 feet | Gr. water | Stoniness

Slope 8% | Moisture

Aspect SE | Root distrib. Well distributed to 24" | % Clay *

Erosion Slight | % Coarse fragments * | % Coarser than V.F.S. *

Permeability Moderate

Additional notes

Soil Samples:
0-4 inches BIL 1103
7-24 inches BIL 1203

Near edge of area disturbed by the road but selected a site that looked undisturbed.
Dug with spade to 24 inches and augered until stopped by a stone.

GROUND COVER (%)	RANGE	AVERAGE
Gravel 2MM-3"		5
Cobble 3-10"		1
Stone 10-24"		
Boulder >24"		
Vegetation		24
Litter		45
Bare		25

* Control section average

Horizon	Depth (inches)	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary	% Rock Fragments	Root Distribution		
A1	0-7	10YR 3/2	Very dark gray 10YR 3/1	15% Sandy loam	MMGR (moderate medium granular)	SH	FR	SS/SP	7.1	gw	5gr	mfm		
AB1	7-12	10YR 4/2	10YR 3/2	Loam 20%	MFSBK	SH	SFI	SS/SP		gw	5gr	mfm		
AB2	12-24	10YR 5/2	10YR 3/3-4/3	Loam 20%	WFSBK	SH	SFI	SS/SP	7.3	cw	8gr	cfm		
C	24-40	10YR 6/1-5/5 Gravelly		SL-L			SFI				15gr 5co	ff		
	40	(larger stones/rock fragments encountered)												

SCS-SOILS-232G

U.S. DEPARTMENT OF AGRICULTURE

SOIL DESCRIPTION

Note

Soil type Soil Map Unit D (edge of B) File No. R-55

Area Rilda Canyon Emery Co., Utah Date 9-4-03 By: D. Larsen Stop No. 5

Classification Disturbed (loamy-skeletal, mixed, superactive, Typic Haplustepts) like Petrhead only deep

Location Near stake for farm site Sec. 20 T16S, R7E

N. veg. (or crop) Pinyon-Juniper Climate Frigid-mesic Ustic

Parent material Colluvium from sandstone and shale

Physiography. Very steep mountain slope

Relief Very steep	Drainage well drained	Salt or alkali
Elevation 7675-7690	Gr. water	Stoniness
Slope ≈ 70%	Moisture	
Aspect South	Root distrib.	% Clay *
Erosion Moderate	% Coarse fragments *	% Coarser than V.F.S. *

Permeability Moderate

Additional notes Cutslope near the old Leroy mine

Sampled cutslope material
Surface 8 inches
Actual cut is probably about
four to five feet into soil
materials
Sample Surface 0-8" RL1303

GROUND COVER (%)	RANGE	AVERAGE
Gravel 2MM-3"		
Cobble 3-10"		
Stone 10-24"		
Boulder >24"		
Vegetation		
Litter		
Bare		

* Control section average

Horizon	Depth (inches)	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary	% Rock Fragments	Root Distribution		
A C	Surface 0-8	10YR 6/3	Brown 10YR 5/3 - 4/3	Loam 20% c			FR	S/P	CS 7.4		35% 10 co 5 ST			
mostly C along cut face														
Undisturbed soil has about 4 inches of A horizon														

SCS-SOILS-232G

U.S. DEPARTMENT OF AGRICULTURE

SOIL DESCRIPTION — Note

Soil type Soil Unit D - Disturbed within B

File No. R-S6

Area Rilda Canyon Emery Co., Utah | Date 9-4-03 | By: D. Larson | Stop No. 6

Classification Disturbed in Haplustepts, Ustorthents, Torriorthents (L-SK)

Location Road to old heavy mine, access to fan site S28, T16S, R7E

N. veg. (or crop) Pinyon-Juniper, grasses | Climate Mesic-Frigid Ustic

Parent material Colluvium from sandstone and shale

Physiography. Very steep mountain slope, canyon side

Relief Very steep	Drainage Well drained	Salt or alkali
Elevation 7600-7660	Gr. water	Stoniness
Slope 40-70%	Moisture	
Aspect South	Root distrib.	% Clay *
Erosion Moderate	% Coarse fragments *	% Coarser than V.F.S. *

Permeability

Additional notes

Sampled: Composite of surface 8 inches along the old roadway

RIL 1403

GROUND COVER (%)	RANGE	AVERAGE
Gravel 2MM-3"		
Cobble 3-10"		
Stone 10-24"		
Boulder >24"		
Vegetation		
Litter		
Bare		

* Control section average

Horizon	Depth (inches)	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary	% Rock Fragments	Root Distribution		
Disturbed AC	0-8"	Yellowish brown 10YR 5/4	Dark yellowish brown 10YR 4/4	15% c Sandy loam		SH	FR SFI	SS/SP	7.4					
Stones and boulders														

SCS-SOILS-232G

U.S. DEPARTMENT OF AGRICULTURE

SOIL DESCRIPTION

Soil type: Soil Map Unit A - Alluvial bottom

File No. R-57

Area: Rilda Canyon, Emery Co., Utah | Date: 9-5-03 | By: D. Larson | Stop No. 7

Classification:

Location: South of stream, east part of project area, parking lot proposed S28 T16S, R7E

N. veg. (or crop): Cottonwood, wild rose, thistles | Climate: Frigid Ustic

Parent material: Alluvium from sandstone and shale

Physiography: Valley bottom, narrow canyon bottom

Relief: Gentle	Drainage: well to moderate well	Salt or alkali
Elevation: 7465 feet	Gr. water	Stoniness
Slope: 7%	Moisture	
Aspect: East	Root distrib.	% Clay *
Erosion: Slight	% Coarse fragments *	% Coarser than V.F.S. *

Permeability: Moderate

Additional notes: Open site with thistles and wild rose. Slightly more sandy than other spots along the valley bottom.

GROUND COVER (%)	RANGE	AVERAGE
Gravel 2MM-3"		
Cobble 3-10"		
Stone 10-24"		
Boulder >24"		
Vegetation		
Litter		
Bare		

* Control section average

Horizon	Depth (inches)	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary	% Rock Fragments	Root Distribution		
A	0-9	10YR 5/3	Dark brown 10YR 3/3	Sandy loam	WFGR	SO	FR	SS/SP	7.3	cw	5gr	mf-m		
AB	9-16		10YR 3/3-4/3	SL	WFSBK	SO	FR	SS/SP		gw	5gr	cf-m		
C1	16-30	10YR 6/2	10YR 4/3 more sandy than above	SL	OM	SH	FR	SS/SP		gw	10gr	cf		
C2	30-42+	Faint mottling starts at about 30 inches		SL	OM SG	SH	FR SFI	SS/SP			20gr	ff		

SCS-SOILS-232G

U.S. DEPARTMENT OF AGRICULTURE

Bilda Canyon Portal Project SOIL DESCRIPTION

-Note-

Soil type Disturbed / Like Winetti

File No. B-58

Area Bilda Canyon | Date 9-5-03 | By: DML | Stop No.

Classification Loamy-skeletal, mixed (calcareous), Frigid Typic Ustifluvents

Location About 80 feet north of the road below the old Rominger Mine

N. veg. (or crop) Sagebrush, rabbitbrush, grasses, Pinyon-Juniper | Climate Frigid / Ustic

Parent material Sandstone and shale; colluvial, alluvial, and transported; plus coal waste material

Physiography Valley bottom at the mouth of a side canyon

Relief Single, gentle slope	Drainage Well drained	Salt or alkali-
Elevation 7465 feet	Gr. water	Stoniness
Slope ≈ 5-7%	Moisture	
Aspect South	Root distrib.	% Clay *
Erosion Moderate	% Coarse fragments *	% Coarser than V.F.S. *

Permeability Moderate

Additional notes Reclaimed area - now mostly grass and some rabbitbrush

Near proposed Topsoil storage site

Mixed coal waste and soil materials

See photo No. 12

Shallow spade excavation

Probably should have had a backhoe pit

GROUND COVER (%)	RANGE	AVERAGE
Gravel 2MM-3"	15	
Cobble 3-10"	15	
Stone 10-24"	9	
Boulder >24"	1	
Vegetation	20	
Litter	10	
Bare	30	

* Control section average

Horizon	Depth (inches)	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary	% Rock Fragments	Root Distribution		
Disturbed AC1	0-6		Brown 10YR 4/3	Cobbly Sandy loam	Weak fine granular	SO-SH	FR	SS/SP		gw	20 G 15 Co 5 ST 5 Sa	Common very fine & fine coal fragments		
AC2	6-14		10YR 4/3-4/4 Spots of black intermingled in soil	"		SH	FI	SS/SP			"	Less roots		

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U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL DESCRIPTION

Notes

Trenched

Soil type

File No. G-1

Area Rilda Canyon by old Leroy min	Date 4-12-04	By: DJ	Stop No. 3
Classification			
Location Fan Site, on flat below + east of site #S-5			
N. veg. (or crop)		Climate	
Parent material			
Physiography			
Relief	Drainage	Salt or alkali	
Elevation	Gr. water	Stoniness	
Slope	Moisture		
Aspect	Root distrib.	% Clay *	
Erosion	% Coarse fragments *	% Coarser than V.F.S. *	
Permeability			

Additional notes Trenched along flat of old road above drainage by old p

pockets of suitable soil probably 8 yds SE

poor soil and coal waste in intermixed with pockets of soil sloughed from slope

≈ 24' Rock < 8" of waste coal + poor soil

mixed soil + coal ≈ 36'

Total 160'

Solid over pocket

* Control section average

Horizon	Depth	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary	% Rock Fragments	Root Distribution		
	0-8-10'													
	by draw, moist spot some grass growing													
							old portal filled in							
												Buried road		

Mostly waste coal + rock ≈ 7-8' at most

white rock

road through + hollow with poor soil up to 16' of "good" soil along south portion

SCS-SOILS-232G

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL DESCRIPTION

Soil type

File No. G2

Area Rilda | Date 4/May | By: Dlarsen | Stop No. 4

Classification

Location About 60-70 feet above the fence line on old road to Leroy mine

N. veg. (or crop) PJ | Climate

Parent material

Physiography

Relief	Drainage	Salt or alkali
Elevation	Gr. water	Stoniness
Slope	Moisture	
Aspect	Root distrib.	% Clay *
Erosion	% Coarse fragments *	% Coarser than V.F.S. *

Permeability

Additional notes

Good rooting to 230"

Suitable soil is about 12 to 30 inches in thickness

* Control section average

Horizon	Depth	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary	% Rock Fragments	Root Distribution		
	C													
e	12-30"		10YR 4/2	Stony loam	subangular						50%		rock frag.	
	30-7 feet		10YR 4/4						very	Smooth				

SCS-SOILS-232G

U.S. DEPARTMENT OF AGRICULTUR
SOIL CONSERVATION SERVICE

SOIL DESCRIPTION

Geo pit #3

Soil type DR

File No. G3

Area Bilda Canyon	Date 4/12	By: DL	Stop No. 5

Classification

Location About 1/3 of the way up the old road to the Fan site (Between Fence & Bilda Ro just above the power line

N. veg. (or crop) Ponderosa, pinyon, juniper, Douglas-fir, Gambel oak, mahog. Climate frigid/mesic ed

Parent material Colluvium mostly from sandstone

Physiography

Relief	Drainage	Salt or alkali High carbonate
Elevation	Gr. water	Stoniness
Slope	Moisture	
Aspect	Root distrib.	% Clay *
Erosion	% Coarse fragments *	% Coarser than V.F.S. *

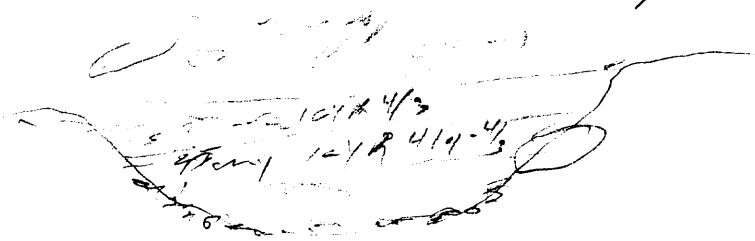
Permeability

Additional notes Good rooting to 24" esp on downhill side of pit

Stony colluvium
Similar to G2

Reference to RS-6
Type of material

High carbonates
Mixed colluvium
and alluvium



* Control section average

Horizon	Depth	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary	% Rock Fragments	Root Distribution		
	0-12		10YR 4/3	co L							Many - Common			
	12-24		10YR 4/4-4/3											
	24-60		10YR 4/4											
	5-9 feet		10YR 5/4											
	Dry below 4 feet													
		Cobbly very gravelly material below about 5 feet												
			Looks alluvial											

SCS-SOILS-232G

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL DESCRIPTION

1 Spits

Soil type

File No. G-4

Area Bibe Canyon	Date 4/12/04	By: D. Larson	Stop No. G-4
Classification			
Location			
N. veg. (or crop)		Climate	
Parent material			
Physiography			
Relief	Drainage	Salt or alkali	
Elevation	Gr. water	Stoniness	
Slope	Moisture		
Aspect	Root distrib.	% Clay *	
Erosion	% Coarse fragments *	% Coarser than V.F.S. *	
Permeability			

Additional notes Very deep soils
Disturbed area
fuel break
Pour 2-4' salvage

Note disturbed area at E.W. end of fuel break loop
- Not disturbed @ [illegible] & paved entry site

esp Mc

Chuck Raysan - silty, sandy gravel

* Control section average

Horizon	Depth	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary	% Rock Fragments	Root Distribution		
	0-28	Wd. gr. brown	10YR 3/2	Loam	wfat		FR	SS SP				Roots 90 15% 90%		
	28-48	mixed					1					2-10% stones		
	48-55	Brown 10YR 4/4-4/3 DK yellowish brown		V SL			4					5-10% bould.		
	to 15 feet													
				Not enough rock fragments for skeletal although it is close										
		within the loop there are some large boulders												
		4-10' diam												

Sampled by Chuck Raysan for any proposals

Site seeded after disturbed [illegible]

SCS-SOILS-232G

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL DESCRIPTION

Soil type

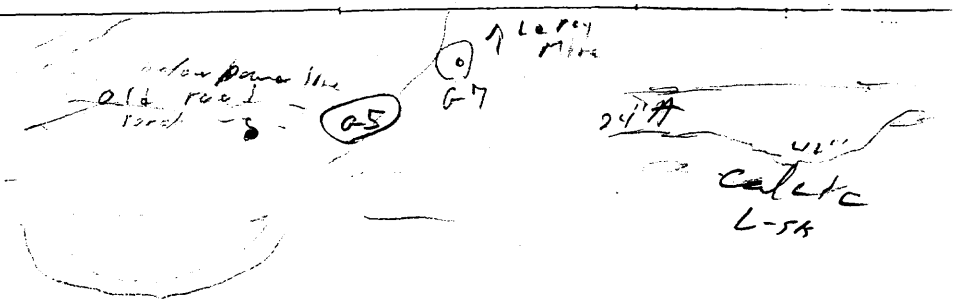
File No. G-5

Area Bilda Canyon	Date 4/13/04	By: Dibaran	Stop No. 1 For 72 L.
Classification Like Stych only a Thick A, Maybe Cuben			
Location West edge of disturbed area			
N. veg. (or crop) P-J, ponderosa		Climate	
Parent material			
Physiography			
Relief	Drainage	Salt or alkali	
Elevation	Gr. water	Stoniness	
Slope	Moisture		
Aspect	Root distrib. Many to common in A to 4½"	% Clay *	
Erosion	% Coarse fragments *	% Coarser than V.F.S. *	
Permeability			

Additional notes

Bouldery surface
Colluvial Toeslope

2-3' of good "Topsoil"



* Control section average

Horizon	Depth	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary	% Rock Fragments	Root Distribution		
A1	0-12	See Sample	les = 10YR 3/2	L-SL		SD	VFR	SS SP	em	gw	10 gr 5 co 5 st 5 B	CF m		
A2	24-32 12-24		10YR 3/2 4/3	L-		SH	VFR SH			aw		"		
BK	24-78		10YR 5/3	ST SL			FR- SFI	SS SP	ev		20 gr 20 co 10 st 5 B			

SCS-SOILS-232G

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL DESCRIPTION

Soil type

File No. G-6

Area Rolda | Date 4/Dec/4 | By: DL | Stop No. 2

Classification

Location Site of road just east of road loop - up slope up the road from RS-4

N. veg. (or crop) | Climate

Parent material

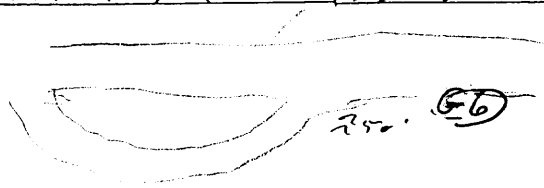
Physiography

Relief	Drainage	Salt or alkali
Elevation	Gr. water	Stoniness
Slope	Moisture	
Aspect	Root distrib.	% Clay *
Erosion	% Coarse fragments *	% Coarser than V.F.S. *

Permeability

Additional notes Below open disturbed site of RS 2+3

coal thins along South side of pit



~~Crop~~ all trees ... small ... Eucalyptus

* Control section average

Horizon	Depth	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary	% Rock Fragments	Root Distribution		
	0-6	mixed soil & road gravel	10YR 3/2	gr L										
	6-20	waste coal												
Gle Suite G.S.	18-23	Dark grayish brown	10YR 4/2	L								5-10% c		
	20-36		10YR 4/3	L								est 5% stone		
	36-50													
	50-60	Dr. yellowish brown	10YR 4/4	v. gr. vfSL-L	est Mk									
	60-15 feet	wet as gravelly clay layer above	10YR 4/4-5/4	SiL										

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U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL DESCRIPTION

Soil type

File No. G-7

Area Rilda Canyon	Date 4/13/04	By: D.L.	Stop No. 2
Classification Stryche like, disturbed			
Location Reclaimed site below Leroy mine above RS-2			
N. veg. (or crop)		Climate	
Parent material			
Physiography			
Relief	Drainage	Salt or alkali	
Elevation	Gr. water	Stoniness	
Slope	Moisture		
Aspect	Root distrib.	% Clay *	
Erosion	% Coarse fragments *	% Coarser than V.F.S. *	
Permeability			
Additional notes			

Coal & soil is quite mixed in pit

More mixed than RS2 and more cobbly below 4 feet

Mixed surface soil layer coal

very cobbly

* Control section average

Horizon	Depth	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary	% Rock Fragments	Root Distribution		
A	0-15.24		10YR 4/3 - 3/3	SL-L								C-M Fine		
coal	24-36													
mixed coal & soil	24-48													
in place colluvium	48-80	v. cobbly calcic layer	as in G5	slightly lighter than material below										
	80-11 feet													

SCS-SOILS-232G

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL DESCRIPTION

Soil type D

File No. G-8

Area Hilda Canyon | Date 4/13/64 | By: D. Larsen | Stop No. 4

Classification waste Coal

Location Just a few feet west of RS 3, below Leray mine

~~N. veg.~~ (or crop) east side of drainage above Telephone pole | Climate

Parent material

Physiography. Toeslope

Relief | Drainage Well drained | Salt or alkali

Elevation | Gr. water | Stoniness

Slope 25-30% | Moisture Moist - Total depth

Aspect S | Root distrib. Few roots through the coal to ≈ 8' | % Clay *

Erosion | % Coarse fragments * | % Coarser than V.F.S. *

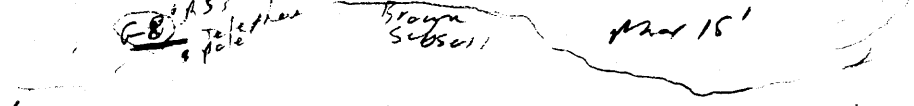
Permeability

Additional notes

Hitachi at pit RS-3

Some boulders mixed in coal on east end

Unit D in reclaimed area may have less surface soil than predicted in soils report - make revisions.



East side of drainage is less than 10

* ~~Control section average~~

Horizon	Depth	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary	% Rock Fragments	Root Distribution		
	0 -			Gravelly loam										
A	4-8"	mixed soil - see RS-3												
	8" - 15 feet max depth	waste coal												
		over brown colluvial soil, not as stony as at G7												
		North side of pit slumped in while digging												

SCS-SOILS-232G

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL DESCRIPTION

Soil type

File No. G 9

Area Bilda Canyon	Date 4/13/64	By: D. Larson	Stop No. 7
Classification			
Location South edge of road below Leroy Mine just N of RS-4C			
N. veg. (or crop)		Climate	
Parent material Mixed colluvium & alluvium			
Physiography edge of road fill			
Relief	Drainage	Salt or alkali	
Elevation	Gr. water	Stoniness	
Slope	Moisture		
Aspect	Root distrib. Good rooting to ≈ 4½ feet	% Clay *	
Erosion	% Coarse fragments *	% Coarser than V.F.S. *	
Permeability			

Additional notes

Upper 3-4 feet would be suitable but below (T.S.) 2 feet it is quite sandy

Similar to RS-4 only it may have more stone with depth

Dark Mixed gravelly cobbly + lighter color stony (layer) T.D. U.P.

G9

* Control section average

Horizon	Depth	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary	% Rock Fragments	Root Distribution		
A	18-24 0-18	minor amount of gravel & soil brown stains	10YR 3/2	SL			FR				10g 5cb	mF cM		
A	18-36	into stains ≈ 50% dr lt + brown	10YR 3/2 - 3/3 patches of 10YR 4/3	SL			FR					cF m		
Low AWC CA	36-60	A few spots [illegible]	dark 10YR 4/4	SL-LS			VFR					↓		
	60-66	gravelly	band	GR SL							60g	F-f om		
	66-100	Gravelly + cobbly	10YR 4/4	Colluvial		SH	FR				70g 20cb 5s 5b			
	11 FT	stones + boulder	10YR 4/4	cob SL							large boulder			

SCS-SOILS-232G

Energy West Proj.

SOIL DESCRIPTION

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

Soil type

File No. G10

Area Bilda Canyon | Date 4/13/04 | By: D. Larsen | Stop No. 5

Classification

Location East end of disturbed area below the Leroy Mine

~~N. veg. (or crop)~~ Bathurst site, NW corner P.J. Ponderosa, C.L. Mtn Mahogany | Climate

Parent material Colluvium from sandstone/waste coal

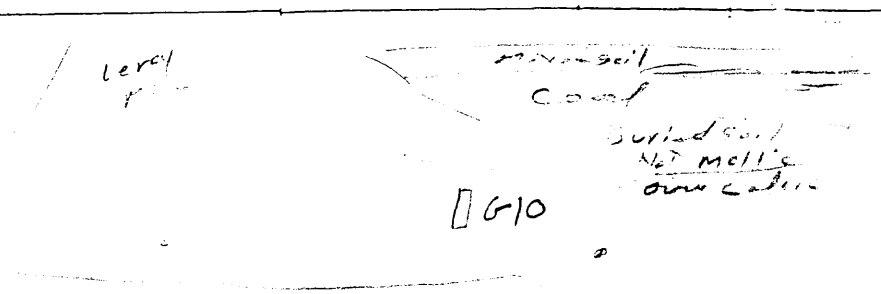
Physiography Toeslope of canyon

Relief	Drainage	Salt or alkali
Elevation	Gr. water	Stoniness
Slope 35%	Moisture	
Aspect South	Root distrib.	% Clay *
Erosion	% Coarse fragments *	% Coarser than V.F.S. *
Permeability		

Additional notes

Typical D as described in soils report

Boulder surface above this disturbed site



* Control section average

Horizon	Depth	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary	% Rock Fragments	Root Distribution		
A	0→8-21" rose 12-16		10YR 4/2-4/3	GR L						aw	30G 10Co 5ST			
D-WC	15-60	waste	Black coal							aw				
AC	60-84		10YR 4/3							gw	10G 5Co			
BK	84-110		10YR 5/4						ev	gw	20G 15Co 10ST			
CK	110" -12 feet		10YR 5/4-4/4	CO L							"			

SCS-SOILS-232G

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL DESCRIPTION

Soil type A/C Mapunit contact

File No. G 11

Area Belle Canyon | Date | By: | Stop No. 6

Classification Coarse-loamy,

Location East of disturbed area below the Leroy mine

N. veg. (or crop) Sagebrush, rabbitbrush, gardener, P-J, Cottonwood ≈ 40' current, wild rose and ws along N side of road

Climate Frigid

Parent material Alluvial materials / colluvium

Physiography. Toeslope / bottomland contact

Relief	Drainage Well drained	Salt or alkali
Elevation	Gr. water	Stoniness
Slope 20%	Moisture Moist to 7-8 feet	
Aspect S	Root distrib. Very good to 3-4 feet	% Clay *
Erosion	% Coarse fragments *	% Coarser than V.F.S. *

Permeability

Additional notes

Similar to RS-4 ≈ 30' from road

Upper 4 feet would be suitable but WHC is low

Some (6") slopewash over the dark surface soil

Mixed layer gravelly - cobbly

Patches of dark soil and lighter sandy soil

D Leroy (6") power pole

Road clearing - long power line

* Control section average

Horizon	Depth	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary	% Rock Fragments	Root Distribution		
A	0-18		10YR 3/3	SL							<20%			
AB	18-40	mixed	10YR 3/3 + 4/4											
	40-84	-	10YR 4/4	SL										
	C 7-8'	very gravelly SL									≈60% gr			
	7'-10'													
	10'-13'	cobbly + stony												

SCS-SOILS-232G

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL DESCRIPTION

Soil type A

File No. 12

Area Relda | Date 4/17/84 | By D. Larsen | Stop No. 8

Classification

Location South side of road, NW of RS-7

N. veg. (or crop) Cottonwood, juniper, rose | Climate

Parent material Sandy alluvium

Physiography

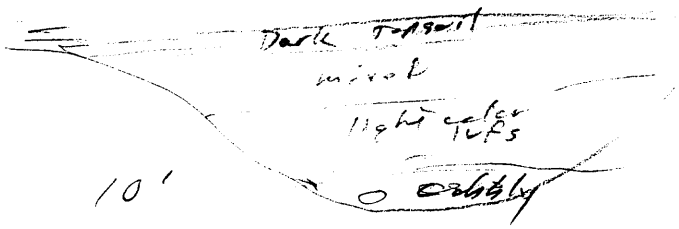
Relief	Drainage	Salt or alkali
Elevation	Gr. water	Stoniness
Slope	Moisture	
Aspect	Root distrib. To 8'	% Clay *
Erosion	% Coarse fragments *	% Coarser than V.F.S. *

Permeability

Additional notes

Similar to RS-7

Parking area



* Control section average

Horizon	Depth	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary	% Rock Fragments	Root Distribution		
A	0-6-12"	Topsoil	10YR 3/2-3/3	SL							<10%			
AC	12-80	Mixed or layered	10YR 3/3 + 4/3 + 5/3											
C	80-100		10YR 6/3-2.5Y 6/3	lfs	OM						few gr			
C	100-120	more cobbly									>25% gr			

few mottles

SCS-SOILS-232G

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL DESCRIPTION

Soil type

File No. G-13

Area	Date	By:	Stop No. 9

Classification

Location Below Ohminger Mine, just N of power line

N. veg. (or crop) | Climate

Parent material Alluvium + waste coal

Physiography Mouth of a side canyon to Bilde Canyon

Relief	Drainage	Salt or alkali
Elevation	Gr. water	Stoniness
Slope 10-15%	Moisture Moist about 4'	
Aspect S	Root distrib.	% Clay *
Erosion	% Coarse fragments *	% Coarser than V.F.S. *

Permeability

Additional notes

At site of RS-8

Very stratified

Nothing much good for Topsoil

Upper 24" is marginal but hardly worth considering as Topsoil

coal
Alluvium
fine gravelly + sandy mixed colors
4 very gravelly
6 Darker old Topsoil
very gravelly + stones, cobbles, boulders to 15 feet

* Control section average

Horizon	Depth	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary	% Rock Fragments	Root Distribution		
	0-6	Mostly soil material										Few to common fine roots		
	6-12	High in coal, dark surface				L	VFR							
12 24 is less gravelly	12-24	Mixed reddish brown + light yellowish brown	5YR 4/6 Cyellowish red									very few below 12"		
	24-60	sandy + gravelly		LS										
	60-70"	Buried soil	10YR 3/2	SL	OM	H	VFi	S'						
	70"-	Very gravelly + stony												
	15 feet													
	70-100"	is lighter colored like an old calcic horizon												
	12-24	is similar to RS-2 below the coal												

SCS-SOILS-232G

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL DESCRIPTION

Soil type

File No. G-14

Area Rside | Date 4/13/84 | By: D. Larson | Stop No. 10

Classification

Location Sediment pond site below Ramsinger Mine, east 1/3 of opening ≈ 40'

N. veg. (or crop) West of Telephone pole + south of Telephone line | Climate about 25' from road

Parent material Alluvium colluvium from sandstone | Veg. Sagebrush - grass opening

Physiography. Alluvial fan

Relief	Drainage	Salt or alkali
Elevation	Gr. water	Stoniness
Slope 20%	Moisture Moist to 3-4 feet	
Aspect SE	Root distrib. Good in upper 4 feet	% Clay *
Erosion	% Coarse fragments *	% Coarser than V.F.S. *

Permeability

Additional notes Sampled 0-12"

Side sloughed in during digging

Salvage - Mixed upper 12" OK

12-48 marginal but acceptable

May have low AWC

Dark

ABk

Dark - old topsoil layer

Subsoil

gravelly calcic

CB

Rd

* Control section average

Horizon	Depth	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary	% Rock Fragments	Root Distribution		
A1	0-6		10YR 3/2	SL			FR				10 gr 5 cb 5 ss	C F, m, C		
ABk	6-26		10YR 4/3 + 3/2 spots	SL			FR				"	"		
A2	26-38		10YR 3/3	SL			FR				"	"		
ABk	38-48		10YR 5/3	SL			FR				"	"		
Bk	48-70	very gravelly - alluvial calcic					Fl 10 feet				65 gr 9 r			
	70+	cobbly stony colluvium									10 gr 15 cb 15 ss 25 B			
	T 13 feet													

SCS-SOILS-232G

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL DESCRIPTION

TP-18

Soil type Dist.

File No. G-15

Area Bilda Canyon - Energy West	Date 4/13/84	By: D. Larsen	Stop No. 3

Classification - Disturbed, waste coal

Location Upper right corner of disturbed area below Thunderhead Mine

N. veg. (or crop) N of drainage at upper edge | Climate

Parent material

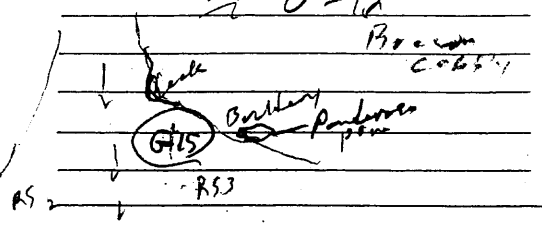
Physiography

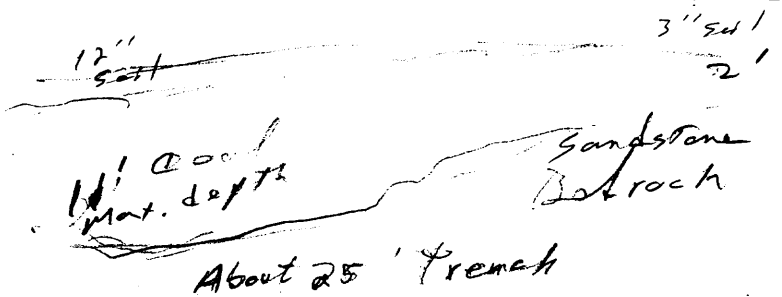
Relief	Drainage	Salt or alkali
Elevation	Gr. water	Stoniness
Slope 45-50%	Moisture	
Aspect S	Root distrib. roots in waste coal to 9'	% Clay *
Erosion	% Coarse fragments *	% Coarser than V.F.S. *

Permeability

Additional notes

Very little soil over the coal
≈ 0-12" Brown Cobbly





* Control section average

Horizon	Depth	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary	% Rock Fragments	Root Distribution		
DA	0-3-12"	Mixed soil like RS-2 + 3										Common R		
DC	12"-11 feet	waste coal										few fine med. to ≈ 9 feet		
	Bedrock is at least 2 feet below 11'													

VOLUME 11

APPENDIX VOLUME

SOILS SECTION

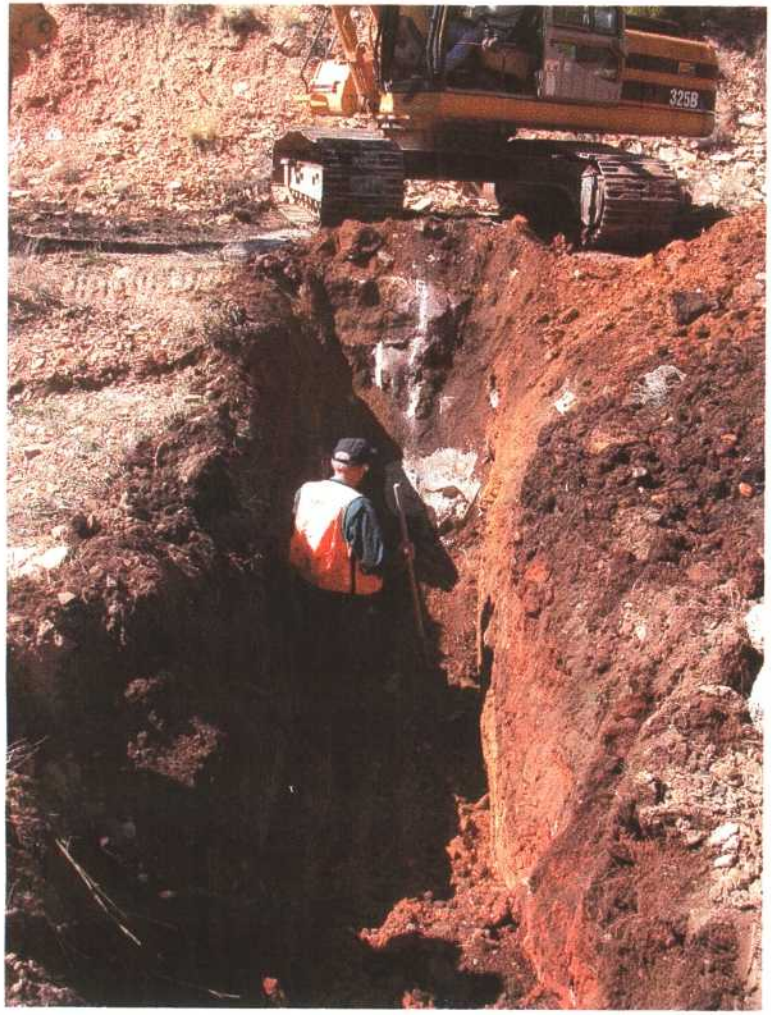
APPENDIX A

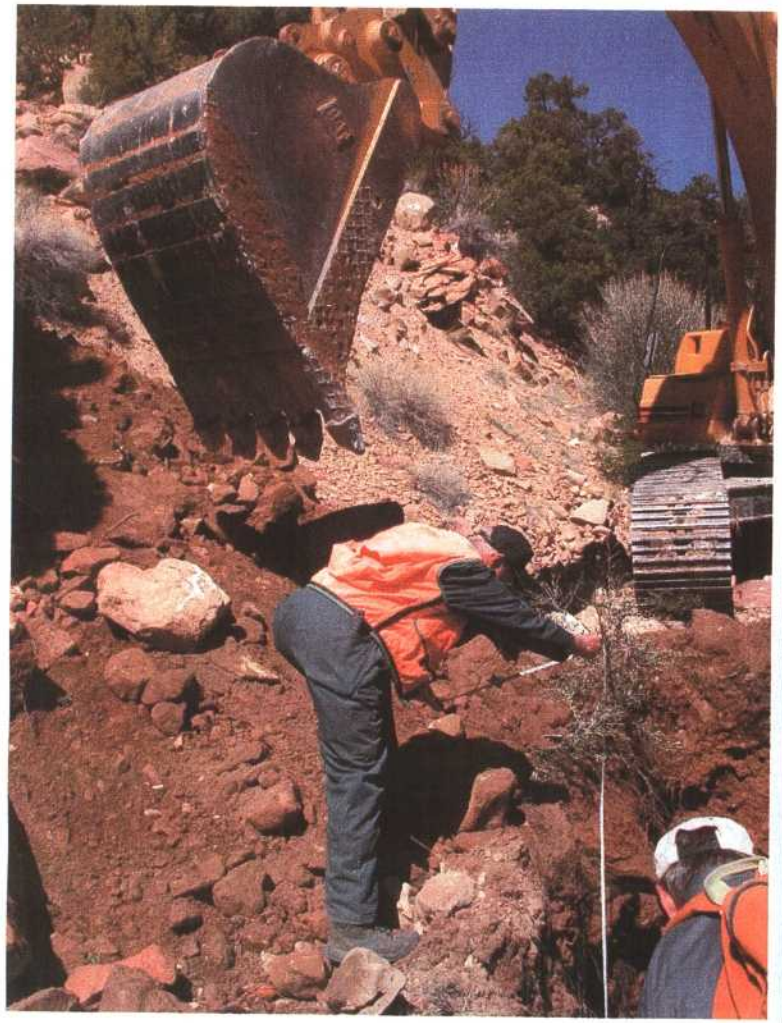
RILDA CANYON PORTAL PROJECT

GEOTECHNICAL/SOIL TRENCHES PHOTOS

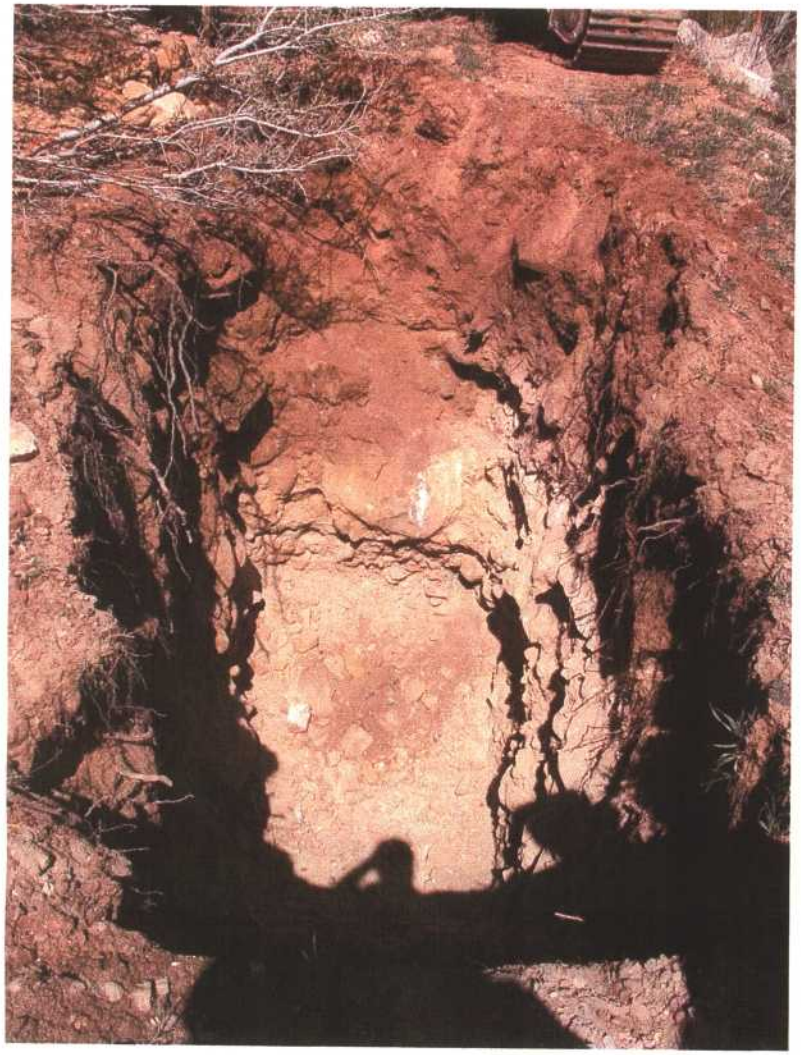
April 12-13, 2004

Rilda Canyon Portal Project
Geotechnical/Soil Trenches
Trench #1
April 12-13, 2004





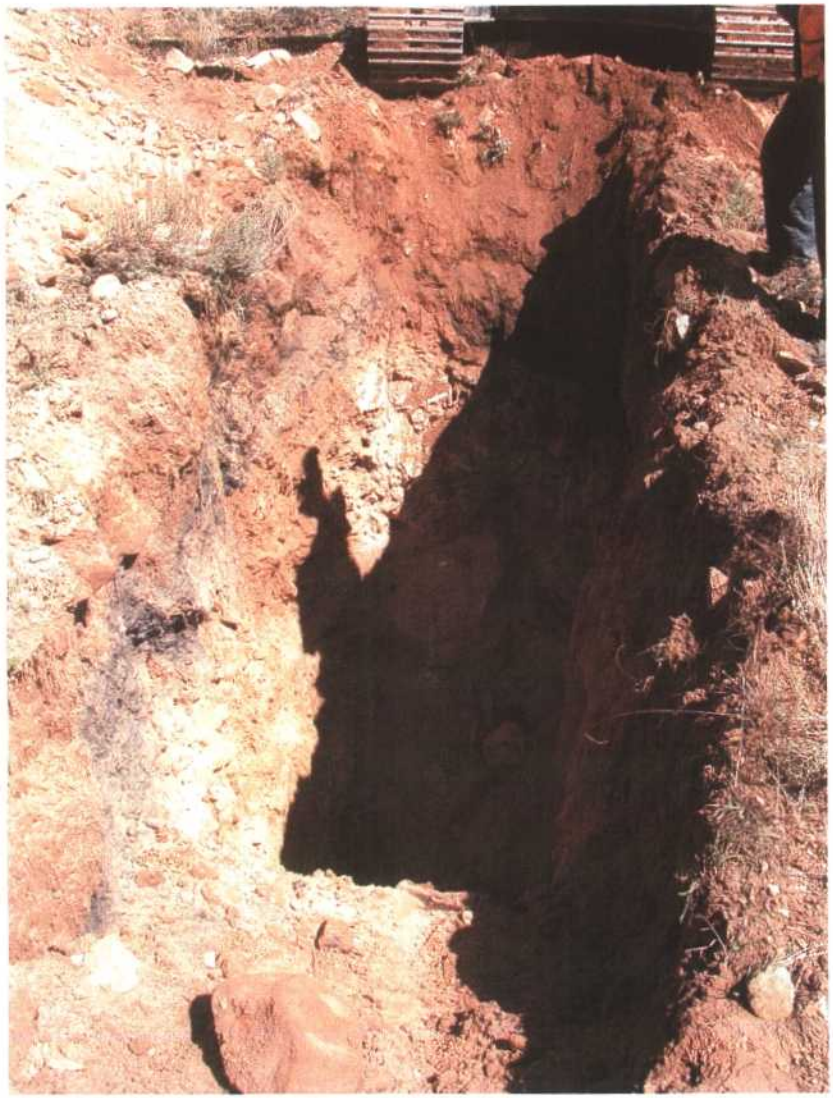
Rilda Canyon Portal Project
Geotechnical/Soil Trenches
Trench #2
April 12-13, 2004

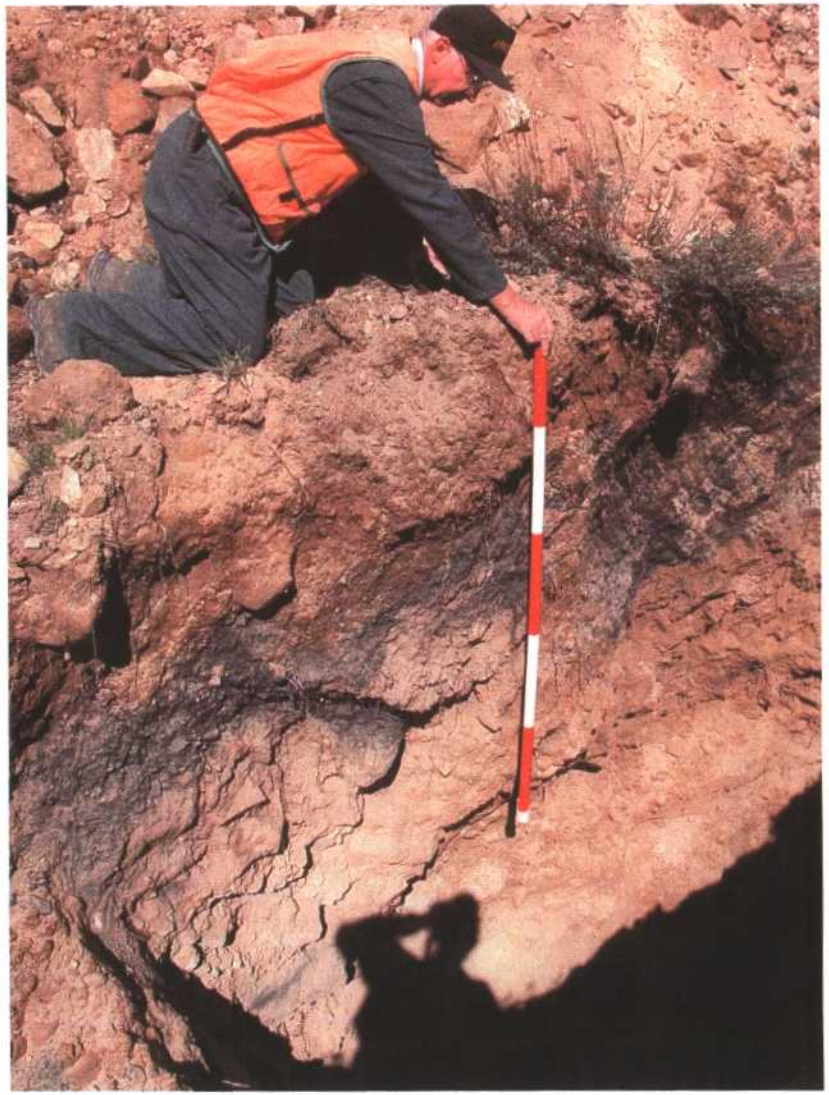


Rilda Canyon Portal Project
Geotechnical/Soil Trenches
Trench #3
April 12-13, 2004

Rilda Canyon Portal Project
Geotechnical/Soil Trenches
Trench #5
April 12-13, 2004

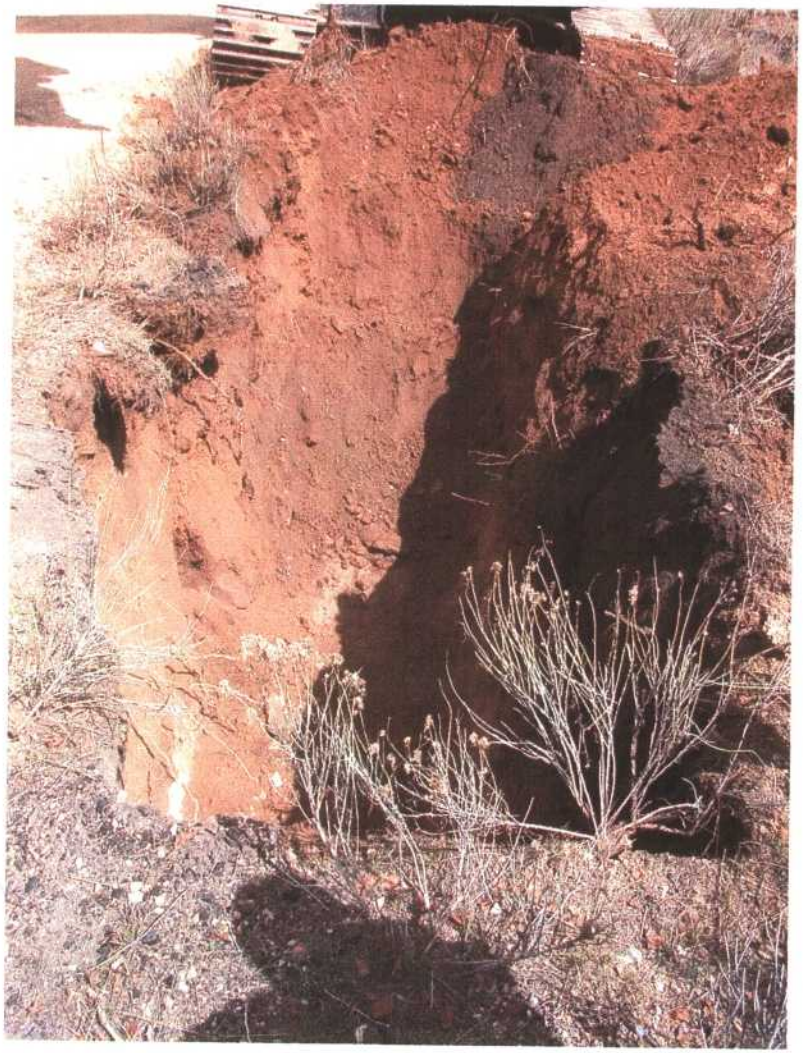
Rilda Canyon Portal Project
Geotechnical/Soil Trenches
No Pictures Were Taken of Trenches 4 & 6
April 12-13, 2004





Rilda Canyon Portal Project
Geotechnical/Soil Trenches
Trench #7
April 12-13, 2004

Rilda Canyon Portal Project
Geotechnical/Soil Trenches
Trench #8
April 12-13, 2004



Rilda Canyon Portal Project
Geotechnical/Soil Trenches
Trench #9
April 12-13, 2004

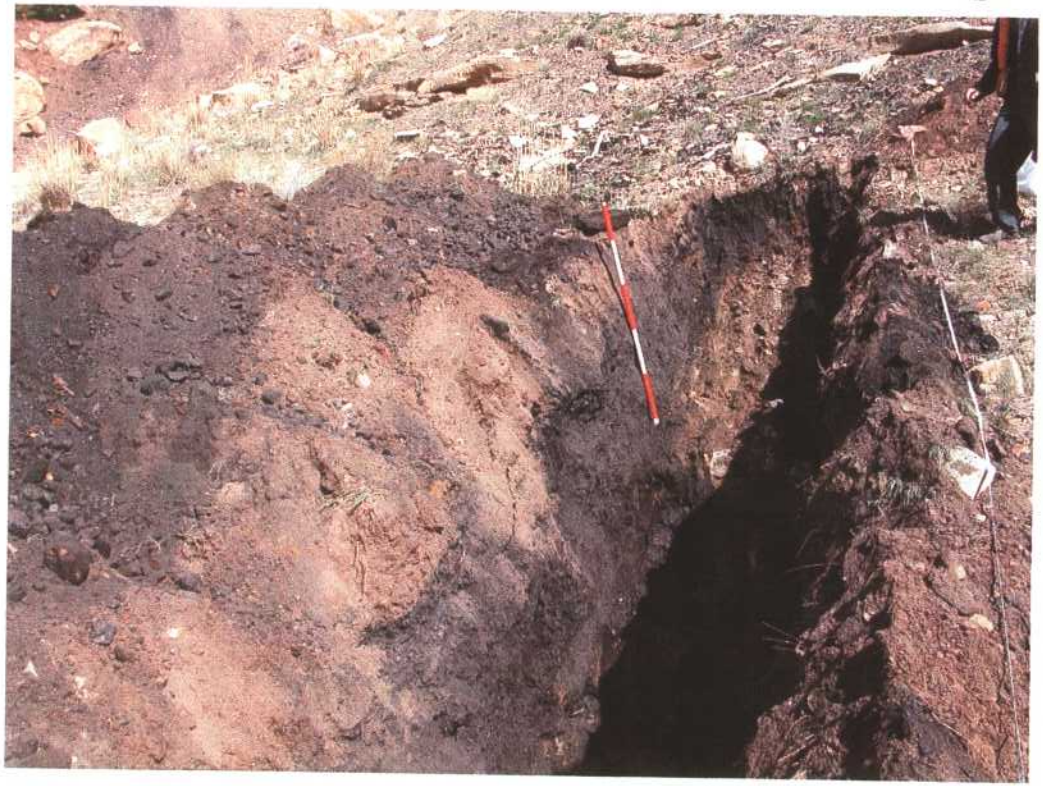
Rilda Canyon Portal Project
Geotechnical/Soil Trenches
Trench #10
April 12-13, 2004

Rilda Canyon Portal Project
Geotechnical/Soil Trenches
Trench #11
April 12-13, 2004

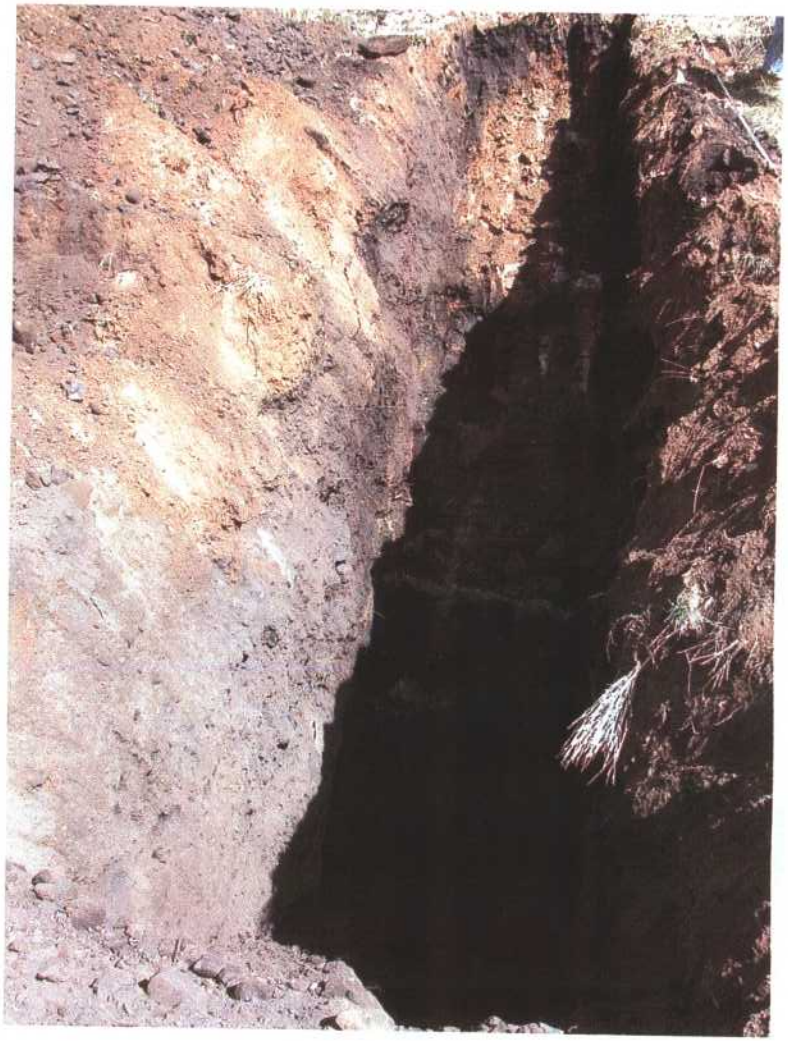
Rilda Canyon Portal Project
Geotechnical/Soil Trenches
Trench #12
April 12-13, 2004

Rilda Canyon Portal Project
Geotechnical/Soil Trenches
Trench #13
April 12-13, 2004

Rilda Canyon Portal Project
Geotechnical/Soil Trenches
Trench #14
April 12-13, 2004



Rilda Canyon Portal Project
Geotechnical/Soil Trenches
Trench #15
April 12-13, 2004



Appendix 6.5

Site and Soil Photographs

Rilda Canyon Portal and Facilities Site
Deer Creek Mine

Rilda Canyon Photographs

Photo 1: Proposed facilities site in Rilda Canyon below the old Leroy Mine. The open area left of the road has been reclaimed from previous mining activities. Soil pits R-S2 and R-S3 were excavated at this site.

Photo 2: South of the road in Rilda Canyon near the proposed facilities site and parking area. The foreground consists of disturbed soil materials from road construction , and merges with the alluvial bottomland along Rilda Creek. Soil pit R-S4 was dug at the edge of the grassy opening.

Photo 3: The south-facing slope in Rilda Canyon at the approximate location of the proposed portal entry. A location stake is in the lower right corner of the photo.

Photo 4: A view of the old road leading to the Leroy Mine and the proposed ventilation fan site. Soil sample R-S6 was taken as a composite of soil materials from the road surface.

Photo 5: Proposed location of the ventilation fan near the old Leroy Mine. Soil sample R-S5 was taken at this site.

Photo 6: The proposed location of the "topsoil" stockpile below the old Rominger Mine in Rilda Canyon. The photo was taken from the road in Rilda Canyon. Most of the soils at the mouth of this side canyon have been disturbed by previous mining activities.

Photo 7: Soil profile of soil pit R-S1 along the alluvial bottomland near the water pipeline. This site is outside of the proposed project boundary, but was used as reference since an open pit was available for observation.

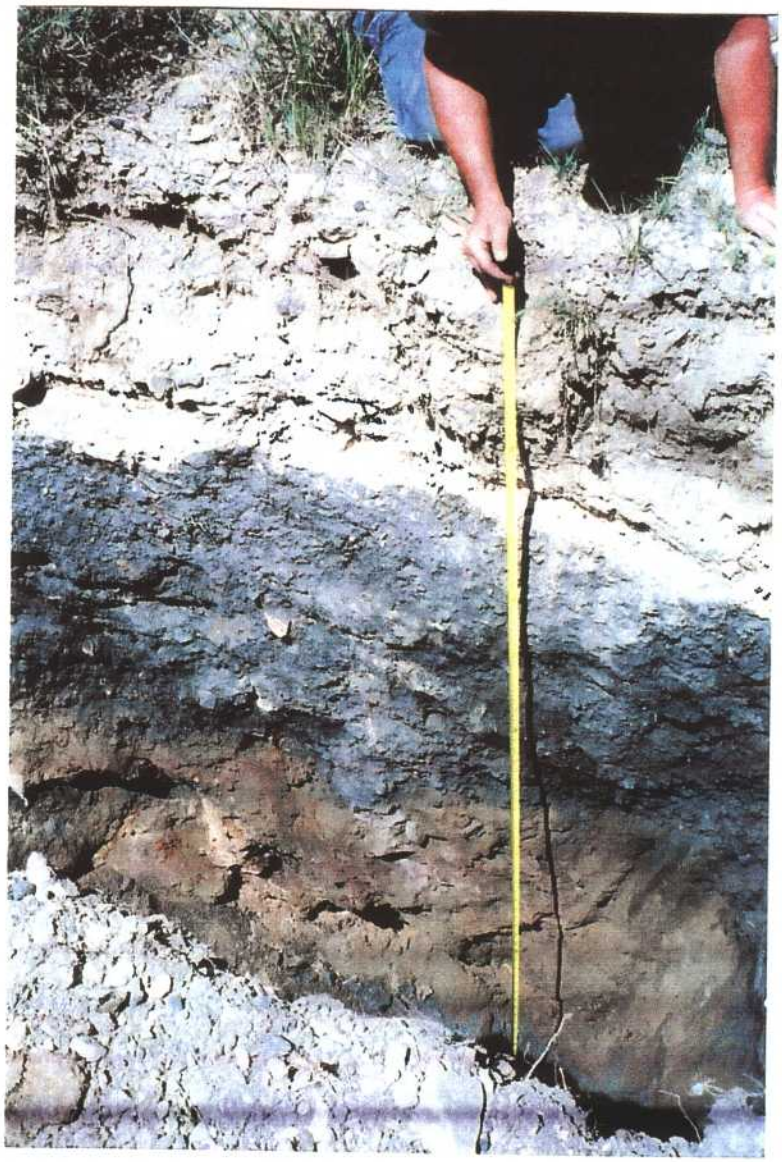


Photo 8: Soil profile of soil pit R-S2 in the disturbed area at the proposed facilities site. Coal waste had been buried at this site during past reclamation activities.

R645-301-200 SOILS SECTION

APPENDIX B

♦ SOIL SURVEY REPORT
OF THE NEW
NORTH RILDA CANYON
PORTAL FACILITIES AREA

MT. NEBO SCIENTIFIC, INC.

JULY 2004

SOIL SURVEY REPORT
OF THE NEW
NORTH RILDA CANYON
PORTAL FACILITIES AREA
2004

Prepared by

MT. NEBO SCIENTIFIC, INC.
330 East 400 South, Suite 6
Springville, Utah 84663
(801) 489-6937

James H. Nyenhuis
Cert. Professional Soil Scientist, ARCPACS 2753

for

ENERGY WEST MINING COMPANY
P.O. Box 310
Huntington, Utah 84528

July 2004

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INTRODUCTION

This report is prepared subsequent to a field study to characterize the soil resources and to determine the potential soil salvage depths of the proposed Rilda Canyon Portal and Facilities Area. The Proposed Disturbance Area is approximately 8.4 acres, with the Expanded Study Area an additional 3.5 acres. The project is associated with Energy West Mining Company's Deer Creek Mine located northwest of Huntington in Emery County, Utah.

Objectives

The basic objectives of the field investigation were to map and describe the soils of the study area in sufficient detail to characterize their physical and chemical properties, and the depths to which they may be salvaged as a source of topsoil for reclamation purposes. Therefore, the site-specific characteristics of the soil that may influence soil salvage, stockpiling, and redistribution were inventoried. A detailed Order 1 soil survey, including mapping, sampling, description, laboratory analysis, suitability evaluation, and report preparation was needed to generate the required information. The general objectives relating to the soil survey are as follows:

- Satisfy soils requirements as found in UDOGM "Guidelines for Management of Topsoil and Overburden for Underground and Surface Mining" (Burton and Davidson, Final Draft, June 2003);

- Collect, review, and evaluate all existing soils, vegetation, geologic, hydrologic, and climatic information to gain a basic understanding of the soils and related disciplines on the site prior to initiation of field work;

- Describe, sample, evaluate, and report site-specific soils data;

- Prepare a soils report, including recommended soil salvage depths, to aid in the completion of the reclamation planning documents needed for permit approval.

METHODS - SCOPE OF WORK

Existing Data Review and Evaluation

All existing soils and related discipline information for the general study area was compiled and reviewed prior to initiation of the soils field work. This review included soils information for the site taken from: (1) "Soil Inventory and Assessment, Rilda Canyon Portal and Facilities Site, Deer Creek Mine" EIS Environmental and Engineering Consulting, May 2004, (2) "Soil Survey of the Rilda Canyon Area", Furst, 1991, and (3) previous USFS mapping in the area and their map unit and taxonomic unit descriptions on file (Manti-LaSal National Forest, June 2004). Project maps and air photos were also reviewed.

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 Natural Resources Conservation Service (NRCS, formerly the Soil Conservation Service) and UDOGM soil survey methods for coal mining projects. Furthermore, all technical specifications were in accordance with current standards and procedures of the USDA-NRCS National Cooperative Soil Survey Program.

Soil Mapping

Mr. James Nyenhuis, Certified Professional Soil Scientist/Soil Classifier (ARCPACS 2753), mapped soils at the Order 1 level of intensity for the proposed area. The study area was approximately 16 acres (15.66) in size and was composed of a Proposed Disturbance Area that would contain mining related facilities, and an Expanded Area that included a portion of the confluence area of the Right and Left Forks of Rilda Creek to the west, and the Rilda Creek alluvial bottomland to the south. The Proposed Disturbance Area was approximately 8.4 acres, not including the proposed soil storage area and road to it that are to the east of the current study area. The mapping and sampling activities were conducted on July 12 through 14, 2004. The field mapping was done utilizing the Rilda Canyon Portal and Facilities Site (Topographic) Map at a scale of 1"=100'.

All standards and procedures for soil mapping and profile description were in accordance with current NRCS methods, as described in the Soil Survey Manual (Soil Survey Staff 1993); National Soils Handbook, as currently amended (Soil Survey Staff 2004); Soil Taxonomy, second edition (Soil Survey Staff 1999), Field Book for Describing and Sampling Soils (Schoeneberger et.al. 2002), and applicable UDOGM topsoil and overburden guidelines (Burton and Davidson,

Final Draft 2003).

Upon initiation of soils field work, traverses were walked to determine overall soil and landscape characteristics. Each major soil/landscape unit was tentatively located on the ground and delineated on the base maps. Observations were also made of cut slopes along the main road up the canyon. Based on these preliminary observations, representative sample sites were selected for detailed soil pedon description and sampling. Because backhoe pits were not allowed, soil pits were hand dug at all sample sites.

Soil Sampling and Profile Description

Each typical soil pedon was described and sampled according to current methods and standards of the National Cooperative Soil Survey. The following parameters were described, by horizon, for each soil pedon: horizon symbol, depth, and boundary; color; texture; structure; consistence; coarse fragment content; effervescence; clay films if present; soil mottles if present; 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.

Samples were collected in the field and analyzed at Colorado State University's Soil Testing Laboratory in Fort Collins, Colorado for standard soil parameters. The soil analyzes included pH; electrical conductivity (EC); saturation percent; calcium, magnesium, and sodium (meq/l); sodium adsorption ratio (SAR), texture including sand, very fine sand, silt, and clay; calcium carbonate percent; organic matter percent (Walkley-Black); and Nitrate Nitrogen, phosphorus, potassium, zinc, iron, manganese, and copper (ppm by AB-DTPA Extract).

All sample locations were flagged and numbered in the field. The sampling site locations and numbers were plotted on the field map as accurately as possible. In addition, the site locations were located by land survey by Energy West Mining Company. Samples were collected from fresh hand-dug pits. The sampled soil material was placed in clean, labeled, polyethylene plastic bags, and kept cool and as dry as possible to limit chemical changes. Each sample was split at the laboratory with one portion being used for analysis and an archival portion retained for additional tests, if necessary.

Ms. Priscilla Burton, UDOGM soil and reclamation specialist, visited the site on July 14. She viewed the site, the developing soils map, and all soil sample locations. She also assisted in the description and sampling of soil site RC4.

Soil Suitability Evaluation

Criteria to establish suitability of soil (topsoil) or soil substitute material were largely those contained in the UDOGM "Guidelines for Management of Topsoil and Overburden for Underground and Surface Coal Mining" Table 4 "Soil and Spoil Suitability/Unsuitability Evaluation" (Burton and Davidson, 2003).

All field and laboratory data have been analyzed and evaluated using standard soil suitability, interpretation, and classification criteria. Soils were classified according to current soil taxonomy criteria as stated in the second edition of Soil Taxonomy (Soil Survey Staff 1999), and then correlated to NRCS soil series as possible.

Correlation of site-specific soils to NRCS soil series, if possible, allows use of established NRCS soil interpretation values such as hydrologic group number (for runoff evaluation), "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 the field and laboratory data and appropriate nomographs.

RESULTS AND DISCUSSION

Review of Existing Soils Information

The soils within the Rilda Canyon site-specific study area have not been previously inventoried to the detailed Order 1 level of intensity. An immediately adjacent area down canyon to the east was mapped by Mr. Dan Larsen (EIS Environmental and Engineering Consulting, 2004). This was the first area proposed for the Rilda Canyon Portal and Facilities Area. A portion of the current proposed disturbance area, the proposed soil stockpile area and road, is still within the previous study area and the Larsen soil study will probably be included in the permit application package.

Map Units A (Alluvial Bottom Land Soils) and RD (Rilda Canyon Road) of the Larsen study were also present on the current study area and these symbols were used in order to be consistent with the previous survey. In addition, one small delineation of Larsen's Map Unit B (Steep Rocky Slopes; Haplustepts, Ustorthents) was present in the northwest corner of the extended portion of the current study area, an area that will not be disturbed by project activities. Likewise, Map Unit B was used for this small delineation in order to be consistent with the previous survey. Map Unit E (Colluvial Toeslopes; Bench) of the current survey was not mapped on the previous survey.

The literature review also included the previous detailed soil survey of a portion of the Left Fork of Rilda Canyon performed as part of a fan installation project (Furst, 1991). The survey area was nearby to the western end of the current study area, and two soils were present on both areas. Previously mapped Brycan bouldery very fine sandy loam (previous map unit BbD) and Shupert gravelly very fine sandy loam (previous map unit SD) were currently delineated as part of Map Unit A (Alluvial Bottom Land Soils). Brycan is the dominant soil in Map Unit A and was sampled at site RC2. Schupert occupies the drainage channel bottom and was not sampled during the current survey nor the previous Larsen survey. Schupert was sampled during the Furst survey. Neither Brycan nor Schupert will be disturbed during current project activities.

The Forest Service soils information for Section 29 (T16S, R7E) in Rilda Canyon was also reviewed (Manti-LaSal National Forest, June 2004). The Forest Service has an old survey of this area, and a new update is in progress. The new soils mapping was only available electronically in the Forest Service office in Price, and the information for the map unit descriptions was not yet available. As such, this newer information was not used in the current survey.

Soil Survey Map

As part of the current survey, a detailed soils map was completed in the field, at a scale of 1"= 100', on a topographic base map of the study area. The soils map is attached to this report. The legend on the map includes all map unit symbols and names, as well as the soil sample locations and numbers.

Five map units were delineated within the current study area and are described in Section 3.4. The map units are:

- Map Unit A, Alluvial Bottom Land Soils
- Map Unit B, Steep Rocky Slopes; Haplustepts, Ustorthents
- Map Unit E, Colluvial Toeslopes; Bench
- Map Unit F, Steep North Facing Slopes; Cryoborolls
- Map Unit RD, Rilda Canyon Road

Soil Laboratory Results

Four soil sites were described and fully sampled (RC1, RC2, RC3, and RC4). RC was used to signify "Rilda Canyon". A total of 21 soil samples were analyzed by Colorado State University's Soil Testing Laboratory in Fort Collins, Colorado. The laboratory results are included as Appendix A.

Soil Profile Descriptions

The detailed soil profile descriptions for the four sample sites (RC1, RC2, RC3, and RC4) are included as Appendix B. The descriptions were completed in the field on standard soil description forms (SCS-Soils-232G).

Soil and Site Photographs

Soil and site photographs are included as Appendix C. Photographs are included for sample sites

RC1, RC2, and RC3. Sample site RC4 was not photographed but is very similar to sites RC1 and RC3.

Soil Map Unit Descriptions

Map Unit A: Alluvial Bottom Land Soils

Alluvial bottomland (Map Unit A) is located along Rilda Creek and in the confluence area of the Left and Right Forks of Rilda Creek. Alluvial bottomland is south of the Rilda Canyon Road and will not be disturbed by mining activities. The project area was moved to its current proposed area from an area immediately down valley in order not to disturb Rilda Creek. An area within the bottomland along the Right Fork of the Rilda Creek, near the confluence with the Left Fork of Rilda Creek, includes the proposed relocation of the Spring Collection Study Area for the North Emery Water Users Association. Slope range of the map unit is 0 to 15 percent. Vegetation within the alluvial bottomland is a mixture of Douglas fir, aspen, and spruce with an understory of grasses and grape holly. Elevation ranges from about 7,600 to 7,750' MSL. The map unit is considered to be in a "frigid" soil temperature regime.

Soils within Map Unit A are very deep (>60" to bedrock), well to somewhat poorly drained, and are developing primarily in streamlain alluvium with some slopewash colluvial material. Soil textures are primarily sandy loam or sandy clay loam. Coarse fragment content is generally less than 15% in the surface layer, and increases to about 20% or more in the subsoil and substratum. Stones and boulders are scattered on the soil surface. Brycan bouldery very fine sandy loam is the dominant soil within the alluvial bottomland, and is described below. Schupert gravelly very fine sandy loam occupies the narrow channel bottom of Rilda Creek within the study area, and was described in the previous survey for the fan installation project (Furst, 1991).

Schupert is a very deep, well drained, slowly permeable soil forming in streamlain alluvium. It is classified as a "Fine-loamy, mixed, superactive, calcareous, frigid Typic Ustifluvent." The most recent official NRCS soil series description for Schupert, dated March 2003, is on file.

Soils within the Alluvial Bottomland have been previously described and/or sampled at three locations (S1, S4, and S7) within the Larsen study area just down valley from the current study area. One representative site, RC2, was described and sampled during the

current survey. Evaluation of the field and laboratory data indicates the soil most closely correlates to the Brycan soil series.

Brycan bouldery very fine sandy loam is a very deep, well drained, moderately permeable soil with slow runoff forming primarily in streamlain alluvium. It is moderately to strongly calcareous. The surface layer meets criteria for a mollic epipedon. Brycan is classified as a "Fine-loamy, mixed, superactive, frigid Cumulic Haplustoll". The most recent official NRCS soil series description for Brycan, dated June 2000, is on file.

Sample site RC2 was located in the Proposed Spring Collection Study Area in the west extension of the study area. At typical sample site RC2, Brycan has a very dark grayish brown (10YR 3/2, dry) sandy loam surface layer about 6 inches thick. The subsoil is a brown (10YR 4/3, dry) sandy clay loam about 12 inches thick. The underlying "BC" transition layer is a brown (10YR 5/3, dry) sandy loam to a depth of about 30 inches. The "C" horizon substratum is a brown (10YR 5/3, dry) sandy loam to a sampled depth of 66 inches. Coarse fragment content ranges from about 10 to 20 percent throughout the soil profile. Scattered stones and boulders are on the soil surface.

Map Unit B: Steep Rocky Slopes; Haplustepts, Ustorthents

One small delineation of Map Unit B was mapped in the northwest corner of the west extension of the study area. This area will not be disturbed by mining activities nor is it in the spring collection area. It was not sampled for laboratory analysis. Map Unit B was also delineated on the Larsen study area. Map Unit B consists of steep to very steep, well drained, rocky slopes. Stones and boulders are commonly scattered on the surface. Sandstone rock outcrop is nearby. Vegetation is dominantly pinyon and juniper. Soil depth ranges from shallow to very deep in stony colluvium. Soils have little profile development, and are high in carbonates. The surface layer is less than 5 inches thick, and can be dark colored in certain areas. The subsoil and substratum layers are often very cobbly to very stony sandy loam to loam with 20 to 35% carbonates.

Map Unit E: Colluvial Toeslopes; Bench

Map Unit E (Colluvial Toeslopes; Bench) is the dominant map unit on the current study area. It is the site for all of the proposed mining and related facilities. Map Unit E occupies a gently sloping alluvial fan toeslope-bench situated between the Star Point Sandstone outcrop located near the base of the steep mountain sideslope and the alluvial

bottomland of Rilda Creek to the south. As such, it is a south-facing slope with mixed, diverse vegetation including Ponderosa pine, Juniper, Douglas fir, some spruce, mountain mahogany, sagebrush, and mixed grasses. Elevation ranges from about 7,600 to 7,730' MSL. The map unit is considered to be in a "frigid" soil temperature regime, and an "ustic" soil moisture regime.

Three representative sites were fully described and sampled within Map Unit E (RC1, RC3, and RC4). All three sites were located midway across the unit, and indicated very deep, well drained soils. Results from seismic testing across this bench indicate an approximate depth of unconsolidated materials (soil above unweathered materials) of 5' on the north end nearby to the Star Point Sandstone outcrop, increasing to a total depth of 50 to 75' on the south end of the bench which ends just north of Rilda Creek alluvial bottomland. Three seismic lines were run across the bench, and the methods and results are contained in a separate report (AMEC Consultants, 2004).

Evaluation of the field and laboratory data for Map Unit E indicates that the soil most closely correlates to the Osote soil series. Osote is an established soil series of small extent mapped in south-central Utah. The most recent official NRCS soil series description for Osote, dated February 1999, is on file. Osote is a very deep, well drained, slowly permeable soil forming in colluvium and slopewash alluvium from sandstone and shale materials. Osote is slightly to strongly calcareous. The surface layer meets criteria for a mollic epipedon. Osote is classified as a "Fine-loamy, mixed, superactive, frigid Typic Calciustoll".

Based on a review of all three sample pedons (RC1, RC3, and RC4), Osote typically has a brown (10YR 4/3, dry) sandy loam to loam surface layer about 9 to 16 inches thick. The lower part of this layer is a "Bw" cambic horizon. The subsoil "Bk" calcic horizon is a brown to light yellowish brown (10YR 5/3 to 10YR 6/4, dry) strongly calcareous sandy loam, sandy clay loam, or loam to a depth of about 20 to 38 inches. The underlying "C" horizon substratum is a yellowish brown to light yellowish brown (10YR 5/4 to 10YR 6/4, dry) sandy loam, sandy clay loam, or loam to a depth of 60 inches (5') on the north side of Map Unit E, and exceeding 84 inches (7') on the south side of the map unit. Slightly weathered, unconsolidated colluvial material extends to a depth of 50 to 75' on the south side of the unit (AMEC Consultants, 2004).

Map Unit F: Steep North Facing Slopes; Cryoborolls

One delineation of Map Unit F (Steep North Facing Slopes; Cryoborolls) was mapped on a north-facing slope above the south side of the Right Fork of Rilda Creek in the western extension area. This area will not be disturbed by mining activities nor is it in the proposed Spring Collection Study Area. It was not sampled for laboratory analysis. Soils on this steep, north-facing slope are best classified as "loamy or loamy-skeletal, mixed, Typic Cryoborolls" with typical slopes of 25 to 60% or more. This map unit dominantly has Douglas Fir and spruce vegetation, with some aspen.

In a typical profile, Typic Cryoborolls have a stony to bouldery sandy loam to loam, dark-colored, surface layer ranging from 10 to 18 inches thick. The surface layer meets criteria for a mollic epipedon. The subsoil is a brown stony to very stony sandy loam or loam. Typic Cryoborolls are well drained.

Map Unit RD: Rilda Canyon Road

Map Unit RD consists of the present road corridor in Rilda Canyon. It was not evaluated as a soil map unit although there are suitable soil materials beneath the road.

Evaluation of Soil Suitability and Topsoil Volume

The Proposed Disturbance Area contains all of the mining facilities associated with this project except for the soil storage area and the road to it that lie to the east on the previous study area surveyed by Larsen. The outline of the proposed facilities is contained as a background layer on the current Soils Map, and has been measured to be approximately 8.4 acres. Map Units E (Colluvial Toeslopes; Bench) and RD (Rilda Canyon Road) are the map units that are within the Proposed Disturbance Area. These are the primary map units that are evaluated for soil suitability and salvage depth recommendation.

Map Units A (Alluvial Bottom Land Soils), B (Steep Rocky Slopes; Haplustepts, Ustorthents), and F (Steep North Facing Slopes; Cryoborolls) are outside the Proposed Disturbance Area and are not proposed for disturbance and soil salvage. Map Units A and B were evaluated during the previous survey, and a recommended salvage depth of 12 to 24 inches, average 18 inches (with a Good suitability rating) was proposed for Map Unit A, and 4 to 8 inches, average 6 inches (with a Fair to Good suitability rating) for Map Unit B (EIS Environmental and Engineering Company, May 2004).

Map Unit F (Steep North Facing Slopes; Cryoborolls) is also not proposed to be disturbed by project activities. Based on similar north-facing soils of projects in other nearby canyons, approximately 24 inches (2') of surface material is suitable for salvage assuming equipment can operate on the steep to very steep slopes. Rock fragment content, particularly stones and boulders, are limiting below 2 feet, and water erosion and landslide hazard would increase with deeper salvage.

Map Unit E (Colluvial Toeslopes; Bench) is the dominant map unit in the Proposed Disturbance Area, and was described and sampled at three locations (RC1, RC3, and RC4). Based on an evaluation of all field and laboratory data, it is recommended that the upper 24 inches (2') of soil material be salvaged for use in future reclamation activities. The soil parameters are generally all suitable (acceptable) throughout the entire soil profile. Soil pH, EC, SAR, texture, organic matter content, and available water capacity are all "good" rated with a few individual horizons "fair" rated (RC3, 38-52", pH 8.5), (RC4, 62-86", pH 8.3 and EC 6.5), (RC4, 48-62", EC 6.1).

The calcium carbonate content (% $CaCO_3$ equivalent) of Map Unit E soils, however, ranges from "good" through "fair" to "poor" rated. Carbonate content ranges from 1.1% to 33.8% in the upper 24 inches, and from 18.6% to a high of 37.7% in the underlying material. The weight-average carbonate percent for the upper 24 inches is 26.4, which is "fair" rated. As such, it is recommended that the upper 24 inches (2') be salvaged for use in reclamation. The moderate to high calcium carbonate content is not a fatal flaw limiting use of this material. Most of the soil parameters are "good" rated. Although the calcium carbonate content, on average, is "fair" rated, it is deemed "acceptable" according to the UDOGM criteria (Table 4 of the Burton and Davidson guideline). If needed, the underlying soil material below 24 inches (2') could also be salvaged for use in reclamation. It has similar soil ratings to depths of 5 to 7 feet.

The Proposed Disturbance Area within the current study area was measured to be approximately 8.4 acres. The current Rilda Canyon road traverses across this area, and is measured to be about 1 acre in size. Soil would not be salvaged from the current road corridor. This results in about 7.4 acres of Map Unit E soils in the Proposed Disturbance Area. Based on a recommended salvage depth of about 24 inches (2'), approximately 23,877 cubic yards of "good" to "fair" rated surface material could be salvaged from Map Unit E soils and stockpiled for use in future reclamation activities. More soil material is available for salvage from Map Unit E soils if needed.

Based on the availability of a sufficient volume of suitable soil material in areas proposed to be disturbed by mining activities, it is concluded that successful reclamation of the Rilda Canyon site

can be achieved if recommended soils are salvaged and good-practice reclamation activities are enacted.

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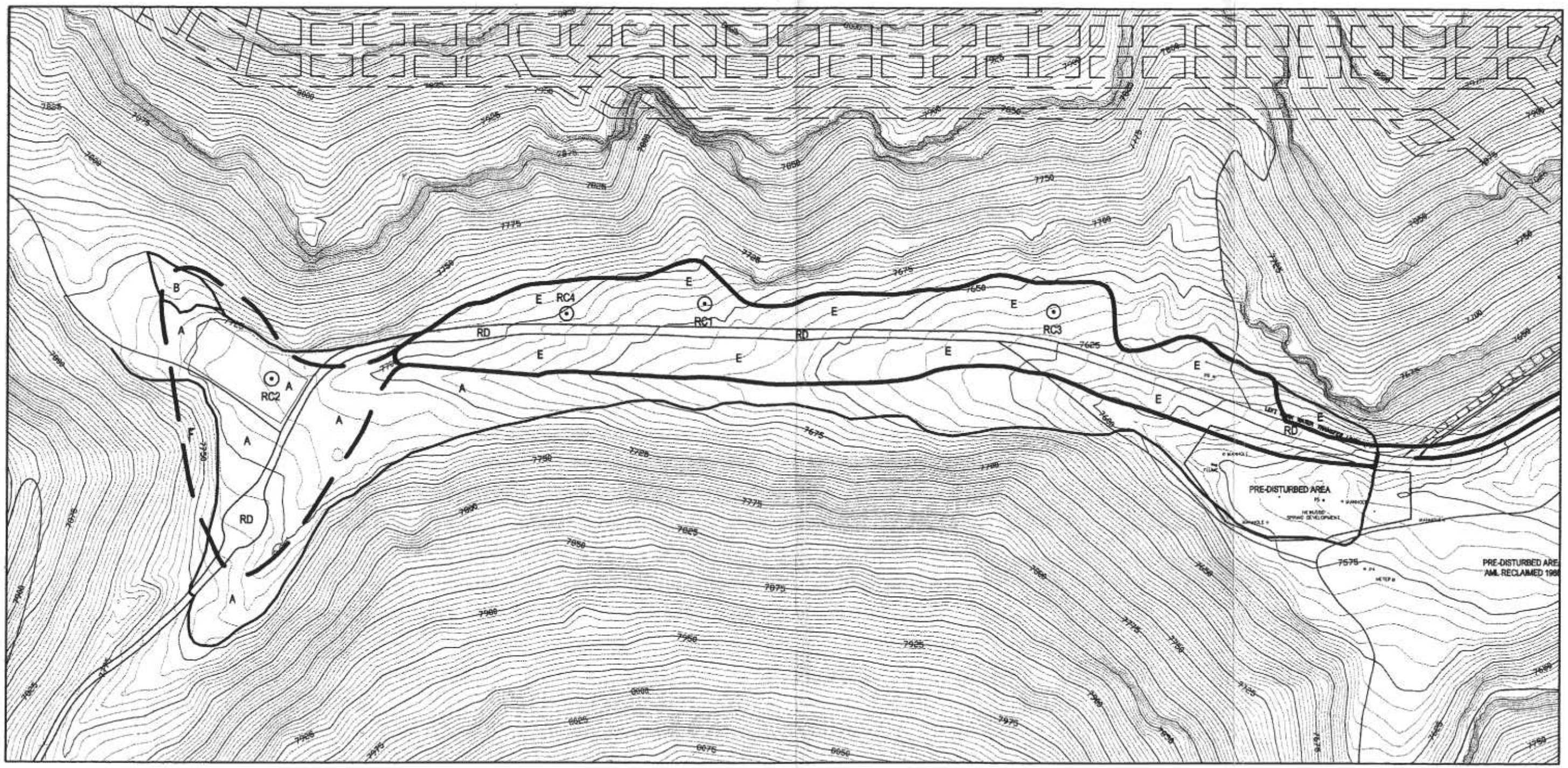

N

LEGEND

A	ALLUVIAL BOTTOMLAND SOILS
RD	RILDA CANYON ROAD
B	STEEP ROCKY SLOPES ; HAPLUSTEPTS, USTORTHENTS
E	COLLUVIAL TOESLOPES; BENCH
F	STEEP NORTH FACING SLOPES; CRYOBOROLLS
⊙	SOIL SAMPLE LOCATIONS
▬	PROPOSED DISTRUBED AREA
▬	EXPANDED AREA

SOILS MAP OF THE
NORTH RILDA CANYON PORTAL FACILITIES

ENERGY WEST MINING COMPANY
HUNTINGTON, UTAH

MT. NEBO SCIENTIFIC, INC.
Research & Consulting
SPRINGVILLE, UTAH

DRAWN BY	J. KILLIAN
MAPPED BY	J. NYENHUIS
CHECKED BY	P. COLLINS
DATE	JULY 31, 2004
SCALE	1" = 200'
REVISIONS	--

APPENDIX A

SOIL LABORATORY RESULTS

Energy West Mining Co.

Huntington UT

Jim Nyenhuis/Certified Soil Scientist

Colorado State University
Soil, Water and Plant Testing Laboratory
Natural & Environmental Sciences Bldg - A319
Fort Collins, CO 80523-1120

(970) 491-5061 FAX: 491-2930

DATE RECEIVED: 07-15-2004
DATE PARTIAL REPORTED: 07-23-2004
DATE REPORTED: 07-28-2004

BILLING:

RESEARCH SOIL ANALYSIS

RILDA CANYON PROJECT

Lab #	Sample ID #	paste pH	paste EC mmhos/cm	% saturation	Lime Estimate	% OM	AB-DTPA ppm NO_3-N	P	K	Zn	Fe	Mn	Cu
R216	RC1 0-3"	7.5	1.2	37.6	Low	4.4	1.8	1.6	192	2.08	13.3	6.11	1.46
R217	RC1 3-10	7.9	0.4	37.1	Medium	3.4	1.5	0.9	104	0.94	9.0	3.23	1.77
R218	RCI 10-20	8.2	0.2	31.1	High	1.8	1.7	<0.1	76.6	0.30	5.6	0.84	1.60
R219	RCI 20-40	8.2	0.2	31.5	High	1.6	1.4	<0.1	87.1	0.37	5.3	0.91	2.09
R220	RC2 0-6"	7.7	0.4	55.7	Low	>8.0	2.0	1.2	200	11.9	35.2	3.92	2.14
R221	RC2 6-18	8.0	0.3	42.3	High	4.2	1.6	0.3	116	1.28	26.1	1.90	2.30
R222	RC2 18-30	8.2	0.3	33.1	High	2.3	1.8	<0.1	96.2	0.38	14.2	1.54	1.18
R223	RC2 30-48	8.2	0.3	36.1	High	2.4	1.2	<0.1	219	0.38	11.9	1.30	1.21
R224	RC2 48-66	8.2	0.3	33.1	High	2.2	1.4	0.3	192	0.36	12.2	1.45	1.46
R225	RC3 0-4	7.7	0.7	48.3	High	>8.0	2.7	4.0	198	3.58	14.8	3.82	2.88
R226	RC3 4-12	8.1	0.5	39.6	High	6.0	2.3	1.2	415	1.92	9.2	2.83	2.27
R227	RC3 12-26	8.2	0.3	38.0	High	4.0	2.4	0.4	271	0.79	6.6	0.86	1.64
R228	RC3 26-38	8.2	0.4	38.8	High	2.8	4.5	0.2	148	0.36	3.4	0.98	1.35
R229	RC3 38-52	8.5	0.4	29.6	High	2.5	3.4	0.7	167	0.29	2.7	0.58	1.00
R230	RC3 52-72	8.6	0.7	33.4	High	2.2	1.1	0.7	103	0.40	2.4	0.93	1.39
R231	RC4 0-4	7.6	0.7	42.5	High	6.6	1.9	2.5	253	3.79	9.5	4.30	1.69
R232	RC4 4-16	8.2	0.3	33.7	High	2.9	1.5	0.6	116	0.53	4.0	1.13	1.13
R233	RC4 16-32	8.2	0.3	33.5	High	3.2	2.5	0.6	135	0.58	4.4	1.20	1.78
R234	RC4 32-48	8.2	2.5	37.9	High	2.8	5.1	0.2	117	0.45	5.5	1.30	1.82
R235	RC4 48-62	8.2	6.1	39.3	High	3.0	2.4	0.6	86.7	0.32	5.3	1.03	0.98
R236	RC4 62-86	8.3	6.5	34.0	High	2.3	4.0	0.5	59.1	0.38	3.5	0.81	1.84

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BILLING:

RESEARCH SOIL ANALYSIS

RILDA CANYON PROJECT

Lab #	Sample ID #	meq/L Ca	meq/L Mg	meq/L Na	meq/L K	SAR	% Sand	% Silt	% Clay	Texture	very fine sand from hydrometer	$CaCO_3$ equiv.
R216	RC1 0-3"	9.3	3.8	0.4	1.9	0.2	69	18	13	Sandy Loam	16.4	1.1
R217	RC1 3-10	4.5	1.5	0.4	0.3	0.2	61	21	18	Sandy loam	11.4	14.6
R218	RCI 10-20	2.2	0.8	0.5	0.2	0.4	61	16	23	Sandy Clay Loam	10.2	17.5
R219	RCI 20-40	2.2	0.9	0.4	0.2	0.3	54	22	24	Sandy Clay Loam	18.9	18.6
R220	RC2 0-6"	4.6	1.4	0.4	0.4.	0.2	58	23	19	Sandy Loam	14.0	3.6
R221	RC2 6-18	3.1	1.1	0.4	0.2	0.3	61	18	21	Sandy Clay Loam	11.4	12.6
R222	RC2 18-30	2.3	1.0	0.4	0.3	0.3	63	18	19	Sandy Loam	14.4	17.7
R223	RC2 30-48	1.9	1.6	0.4	0.6	0.3	62	19	19	Sandy Loam	12.4	14.0
R224	RC2 48-66	2.1	1.9	0.5	0.6	0.4	62	19	19	Sandy Loam	12.6	14.5
R225	RC3 0-4	7.5	2.3	0.5	0.9	0.2	62	28	10	Sandy Loam	13.7	31.9
R226	RC3 4-12	3.6	1.6	0.5	2.1	0.3	46	36	18	Loam	16.5	32.5
R227	RC3 12-26	2.4	0.9	0.6	1.2	0.5	53	29	18	Sandy Loam	12.9	33.8
R228	RC3 26-38	2.9	2.0	0.5	0.6	0.3	60	22	18	Sandy Loam	14.2	35.2
R229	RC3 38-52	1.4	3.8	0.5	0.6	0.3	55	26	19	Sandy Loam	15.8	37.7
R230	RC3 52-72	1.2	8.0	2.2	0.4	1.0	56	25	19	Sandy Loam	15.9	35.5
R231	RC4 0-4	7.6	2.7	0.4	1.4	0.2	63	29	8	Sandy Loam	19.6	29.0
R232	RC4 4-16	2.9	1.0	0.4	0.3	0.3	60	25	15	Sandy Loam	19.4	31.7
R233	RC4 16-32	2.0	1.3	0.4	0.3	0.3	57	28	15	Sandy Loam	17.0	31.7
R234	RC4 32-48	8.9	17.8	6.1	0.7	1.7	49	30	21	Loam	16.0	31.8
R235	RC4 48-62	18.9	29.1	18.4	0.9	3.8	44	34	22	Loam	15.0	32.1
R236	RC4 62-86	21.5	29.4	19.8	0.9	3.9	45	33	22	Loam	17.1	33.2

APPENDIX B

FIELD SOIL PROFILE DESCRIPTIONS

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL DESCRIPTION

SCS - SOI - 232C
Rev. 2 - 81

Soil type: OSOTE Mapkmit E J. NYENHUIS File No.

Area: ENERGY WEST RILDA CANYON | Date: 7-13-04 | Stop No. RC 2

Classification: Fine-loamy, mixed, superactive, frigid Typic Calciustoll

Location: excellent veg (grazed cattle)

N. veg. (or crop): Douglas fir, spruce, Juniper, sagebrush, mtn mahogany, mixed grasses, Ponderosa pine | Climate: frigid temp

Parent material: slopewash colluvium

Physiography: colluvial fan slope bet. ridge side & drain

Relief	Drainage: well	Salt or alkali: —
Elevation: 7680'	Gr. water: deep	Stoniness
Slope: 10%	Moisture: all dry to 20" sl. moist 20-40"	
Aspect: South	Root distrib.: MRD 0-10" Many Co, M, F, VF 0-10"	% Clay *
Erosion: none	% Coarse fragments * Few to Com Co, M, F, VF 10-20" Few Co, M, F, VF 20-40"	% Coarser than V.F.S. *
Permeability: moderate		
Additional notes		

Samples: 0-3, 3-10, 10-20, 20-40 (4 samples)

scattered co frags on surface including few stones & boulders stopped by rx at 40", cut bank ranges up to

* Control section average

Horizon	Depth	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary	Co Frags		
A	0-3	10YR 4/3	10YR 3/3	12% c SL	MM GR	SO-SH	VFR	NS/SP	SE	GS	10% GR		
A/Bw	3-10+	10YR 4/3	10YR 3/3	17% c L SL	MM SBK	SH	FR	SS/SP	EM	GW	15% GR		
B/k	10-20	10YR 5/3	10YR 4/3	22% c sl SCL	MM SBK	H	FR	S/SP	ES-	GW	20%	GR &	CB
C	20-40+	10YR 5/4	10YR 4/4	23% c loam/ SCL	Mass	H	FR to FI	SS/P	ES	—	25%	GR &	CB

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL DESCRIPTION

SCS - SOI - 232(
Rev. 2 - 81

Soil type: BRYCAN Map Unit A J. NUENHUIS File No.

Area: ENERGY WEST RILDA CANYON Date: 7-13-04 Stop No.: RC2

Classification: Fine-loamy, mixed, superactive, frigid Cumulic Haplustoll

Location

N. veg. (or crop): Spruce, Douglas fir, aspen, understory includes grape holly, grasses Climate: frigid temp

Parent material: streamlain & some sheetwash alluv.

Physiography: Alluvial bottomland

Relief	Drainage: well and well	Salt or alkali: —
Elevation: ~7720'	Gr. water: deep	Stoniness
Slope: 6%	Moisture: A dry, Bw dry, BC sl. moist	
Aspect: East	Root distrib.: MRD 0-18" Many co, m, F, VF 0-18	% Clay *
Erosion: sl. (mass caused)	% Coarse fragments * see below	% Coarser than V.F.S. *
Permeability: moderate	com to Few co, m, F, VF 18-30; few co, m, F, VF 30+	
Additional notes		

Samples: 0-6, 6-18, 18-30, 30-48, 48-66 (Examples)

Brycan series (Furst 1991)
scattered stones & boulders on surface

* Control section average

Horizon	Depth	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary	Co Frags
A	0-6	10YR 3/2	10YR 2/2	Sandy Loam	MM GR	SH	FR	SS/SP	SE	GS	15% GR
Bt	6-18	10YR 4/3	10YR 2/2	Sandy Clay Loam	MM SBK	SH-H	FR	SS/P	EM	GW	20% GR
BC	18-30	10YR 5/3	10YR 3/3	Sandy Loam	Massive	SH-H	FR	SS/P	ES-	GW	20% GR
C1	30-48	10YR 5/3	10YR 3/3	Sandy Loam	Massive	SH	FR	SS/P	ES+	GW	10% GR
C2	48-66	10YR 5/3	10YR 4/3	Sandy Loam	Massive	SH	FR	SS/P	ES	GW	15% GR
	stopped by rx at		66"								

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL DESCRIPTION

SCS - SOI - 232C
Rev. 2 - 81

Soil type: OSOTE Map unit E J. NYENHUIS File No.

Area: WESTERN ENERGY RILDA CANYON Date: 7-14-04 Stop No. RC3

Classification: Fine-loamy, mixed, superactive, frigid Typic Calciustoll

Location: dug tracts a deep cut

N. veg. (or crop): sagebrush, rabbitbrush, columnar juniper, some doug fir, mtn mahogany, fir, aspen, ponderosa pine Climate: frigid temp

Parent material: slopewash colluvium

Physiography: short fan-colluvial slope. toeslope but steep sideslope & drain

Relief	Drainage: well	Salt or alkali: —
Elevation: 7635'	Gr. water: deep	Stoniness
Slope: 8%	Moisture: dry	
Aspect: South	Root distrib. MRD 0-12 Many co, m, F, VF 0-12,	% Clay *
Erosion: none	% Coarse fragments * common to few co, m, F, VF 12-26	% Coarser than V.F.S. *

Permeability: moderate

Additional notes

site v. similar to RC1

Samples: 0-4, 4-12, 12-26, 26-38, 38-52, 52-72+ (6 samples)

surface has scattered stones & boulders

* Control section average

Horizon	Depth	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary	Co. Frags.
A	0-4	10YR 4/3	10YR 3/3	SL	MM GR	SO	VFR	SS/SP	EM	GS	10% GR
A/Bw	4-12	10YR 5/3, 4/3	10YR 3/3	Loam	MM SBK	SH	FR	SS/P	EM+	GW	15% GR
Bw	12-26	10YR 5/4	10YR 4/4	Sandy Loam	MM SBK	H	FR	SS/P	ES	GW	20% GR
Bk1	26-38	10YR 6/4	10YR 5/4	SL	Massive	H	FR	SS/P	ES+	GW	35% GR
C1	38-52	10YR 6/4	10YR 5/4	SL	Massive	H	FR	SS/P	ES+	GW	30% GR
C2	52-72+	10YR 6/4	10YR 5/4	SL	Massive	H	FR	SS/P	ES	GW	20% GR

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

SOIL DESCRIPTION

SCS - SOI - 232C
Rev. 2 - 81

Soil type: OSOTE Map Unit E J. NYENHUIS File No.

ENERGY WEST RILDA CANYON | Date 7-14-04 | Stop No. RC4

Classification: Fine-loamy, mixed, superactive, frigid Typic Calciustoll

Location

N. veg. (or crop): sagebrush, rabbitbrush, PJ, columbian juniper, ponderosa pine | Climate: frigid temp

Parent material: colluvium (Mogollon)

Physiography: short fan, colluvial slope bet. ridge side slope & drain

Relief	Drainage: well	Salt or alkali
Elevation: 7705'	Gr. water: deep	Stoniness
Slope: 8%	Moisture: dry to 16", al. moist 16 & below	
Aspect: South	Root distrib.: MRD 0-16" Many M, F, VF 0-16	% Clay *
Erosion: none	% Coarse fragments *: Few M, F, VF 16-32	% Coarser than V.F.S. *

Permeability: moderate

Additional notes

v. similar to RC1, RC3

Samples: 0-4, 4-16, 16-32, 32-48, 48-62, 62-86 (6 samples)

* Control section average

Horizon	Depth	Color Dry	Color Moist	Texture	Structure	Consistence Dry	Consistence Moist	Consistence Wet	Reaction	Boundary	Co Frags			
A	0-4	10YR 4/3	10YR 3/3	SL	MM GR	SO	VFR	NS/NP	SE	GS	10% GR			
B/Bw	4-16	10YR 5/3	10YR 4/3	Sandy Loam	MM SBK	SH	FR	SS/SP	EM	GW	20% GR			
BK	16-32	10YR 5/4	10YR 4/4	Sandy Loam	Mass.	H	FR	S/P	EM+	GW	10% GR			
C1	32-48	10YR 5/4	10YR 4/4	Loam, Clay Loam	Mass	H	FR	S/P	ES	GW	10% GR			
C2	48-62	10YR 5/4	10YR 4/4	Loam, Clay Loam	Mass	H	FR	S/P	ES	GW	10% GR			
C3	62-86	10YR 5/4	10YR 4/4	Loam, CL	Mass.	H	FR	S/P	ES	GW	10% GR			

APPENDIX C

SOIL AND SITE PHOTOGRAPHS:

Photograph 1	RC1, Osote soil profile close-up, Map Unit E
Photograph 2	Map Unit E site, RC1 Osote soil profile in middle
Photograph 3	RC2, Brycan soil profile close-up, Map Unit A
Photograph 4	RC2, Map Unit A site, Brycan soil profile in middle
Photograph 5	Map Unit A site, looking west
Photograph 6	RC3, Osote soil profile close-up, Map Unit E
Photograph 7	RC3, Osote soil profile, further close-up, Map Unit E
Photograph 8	Map Unit E site, RC3 Osote soil profile in middle
Photograph 9	Map Unit E site, RC3 Osote soil profile in center-right

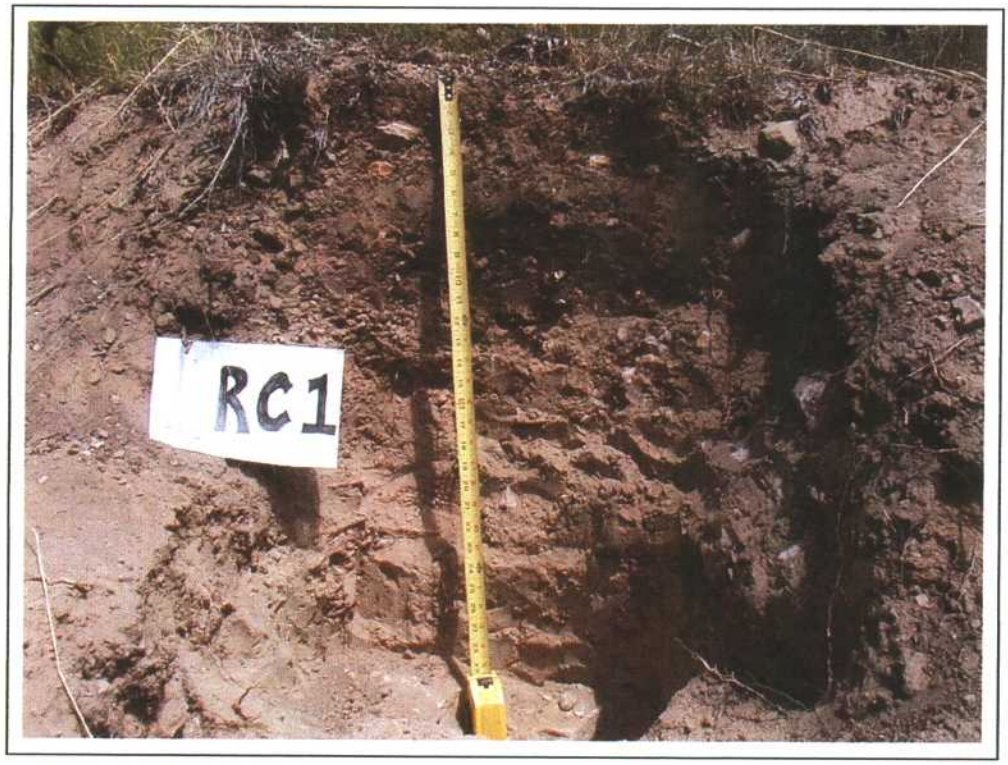


Photo 1: Site RC1, Osote soil profile close-up, Map Unit E.

Photo 2: Map Unit E site, RC1 Osote soil profile in middle.

Photo 3: Site RC2, Brycan soil profile close-up, Map Unit A.

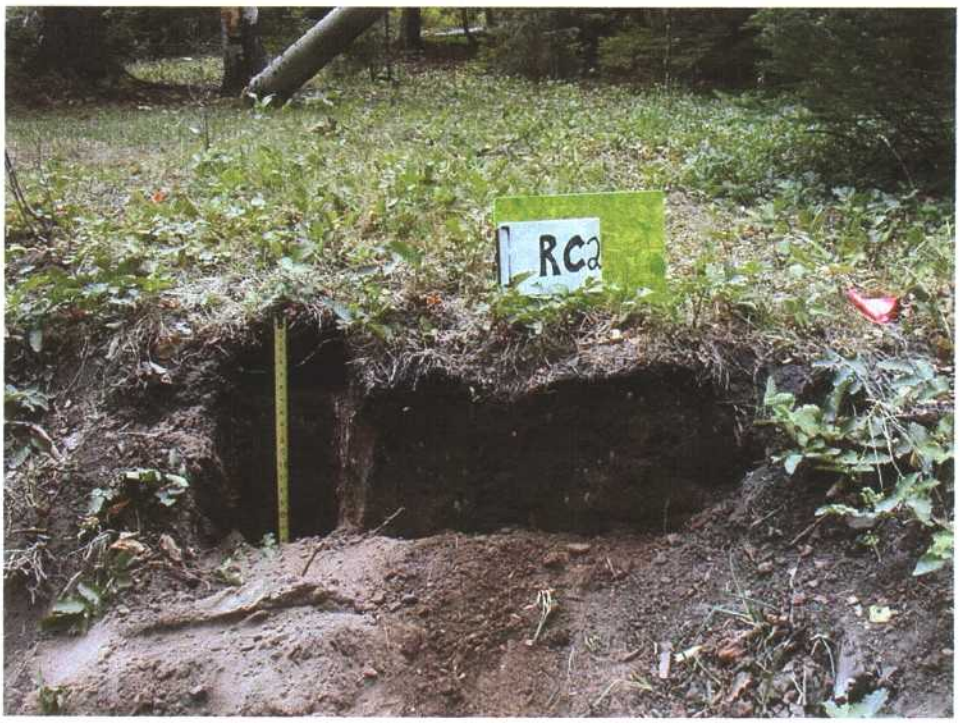


Photo 4: Site RC2, Map unit A site, Brycan soil profile in middle.

Photo 5: Map Unit A looking West.

Photo 6: Site RC3, Osote soil profile close-up, Map Unit E.

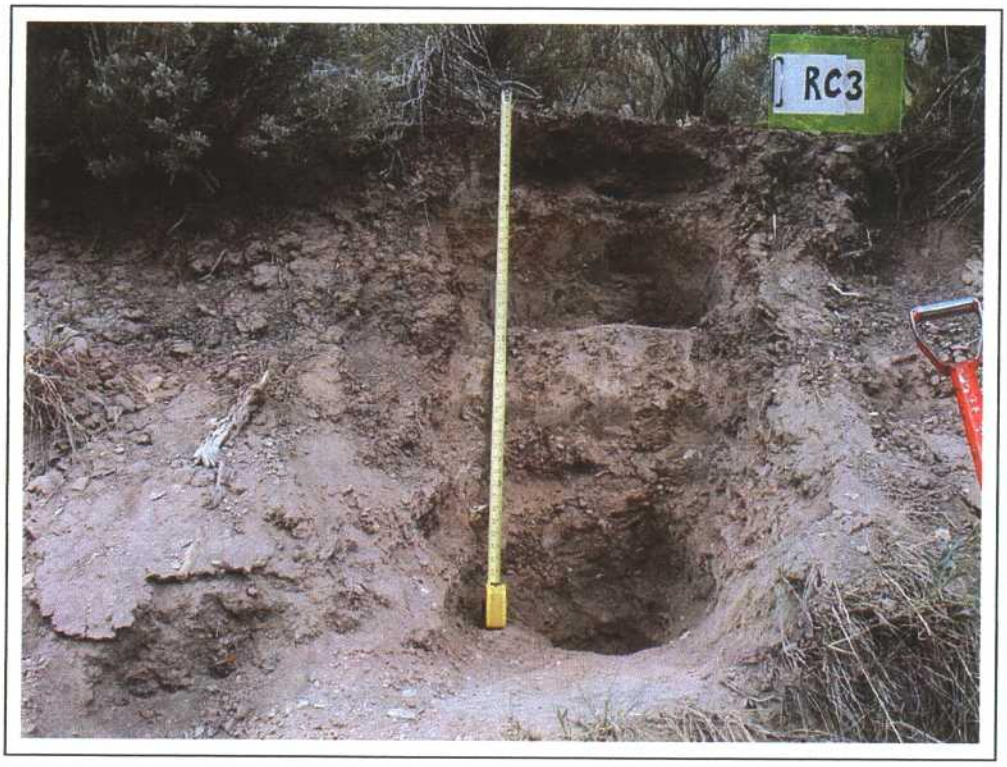


Photo 7: Site RC3, Osote soil profile, further close-up, Map Unit E.

Photo 8: Map Unit E site, RC3 Osote soil profile in middle.

Photo 9: Mape Unit E site, RC3 Osote soil profile in center-right.

SOIL SURVEY REPORT
OF THE NEW
NORTH RILDA CANYON
PORTAL FACILITIES AREA

ADDENDUM

SOIL STORAGE SURVEY

DECEMBER 2004

ADDENDUM

SOIL STORAGE SURVEY

MT. NEBO Scientific, Inc., Mr. James Nyenhuis, Certified Professional Soil Scientist/Soil Classifier (ARCPACS 2753), mapped soils at the Order 1 level of intensity for the proposed soil storage areas on December 9, 2004. The basic objectives of the field investigation were to map and describe the soils of the topsoil and subsoil/construction storage areas in sufficient detail to characterize their physical and chemical properties. Therefore, the site-specific characteristics of the soil that may influence stockpiling, and redistribution were inventoried. A detailed Order 1 soil survey, including mapping, sampling, description, laboratory analysis, suitability evaluation, and report preparation was needed to generate the required information. The general objectives relating to the soil survey are as follows:

- Satisfy soils requirements as found in UDOGM "Guidelines for Management of Topsoil and Overburden for Underground and Surface Mining" (Burton and Davidson, Final Draft, June 2003);
- Collect, review, and evaluate all existing soils, vegetation, geologic, hydrologic, and climatic information to gain a basic understanding of the soils and related disciplines on the site prior to initiation of field work;
- Describe, sample, evaluate, and report site-specific soils data;
- Prepare a soils report, to aid in the completion of the reclamation planning documents needed for permit approval.

Findings of the soil storage survey will be included as Appendix B when available.

R645-301-200 SOILS SECTION

APPENDIX C

♦PRIME FARMLAND DETERMINATION
DEER CREEK MINE

NRCS

OCTOBER 2004

NRCS Natural Resources Conservation Service

NRCS Utah

United States Department of Agriculture

Natural Resources Conservation Service

Price Office
350 North 400 East
Price, Utah
84501

Phone:
435 637-0041

FAX
435 637-3146

October 14, 2004

Charles A. Semborski
Manager Geology/Permitting
Energy West Mining Company
P.O. Box 310
Huntington, Utah 84528

RE: Proposed Rilda Canyon Portal Facilities, PacifiCorp, Dear Creek Mine, C015/018
Emery County, Utah

Dear Mr. Semborski

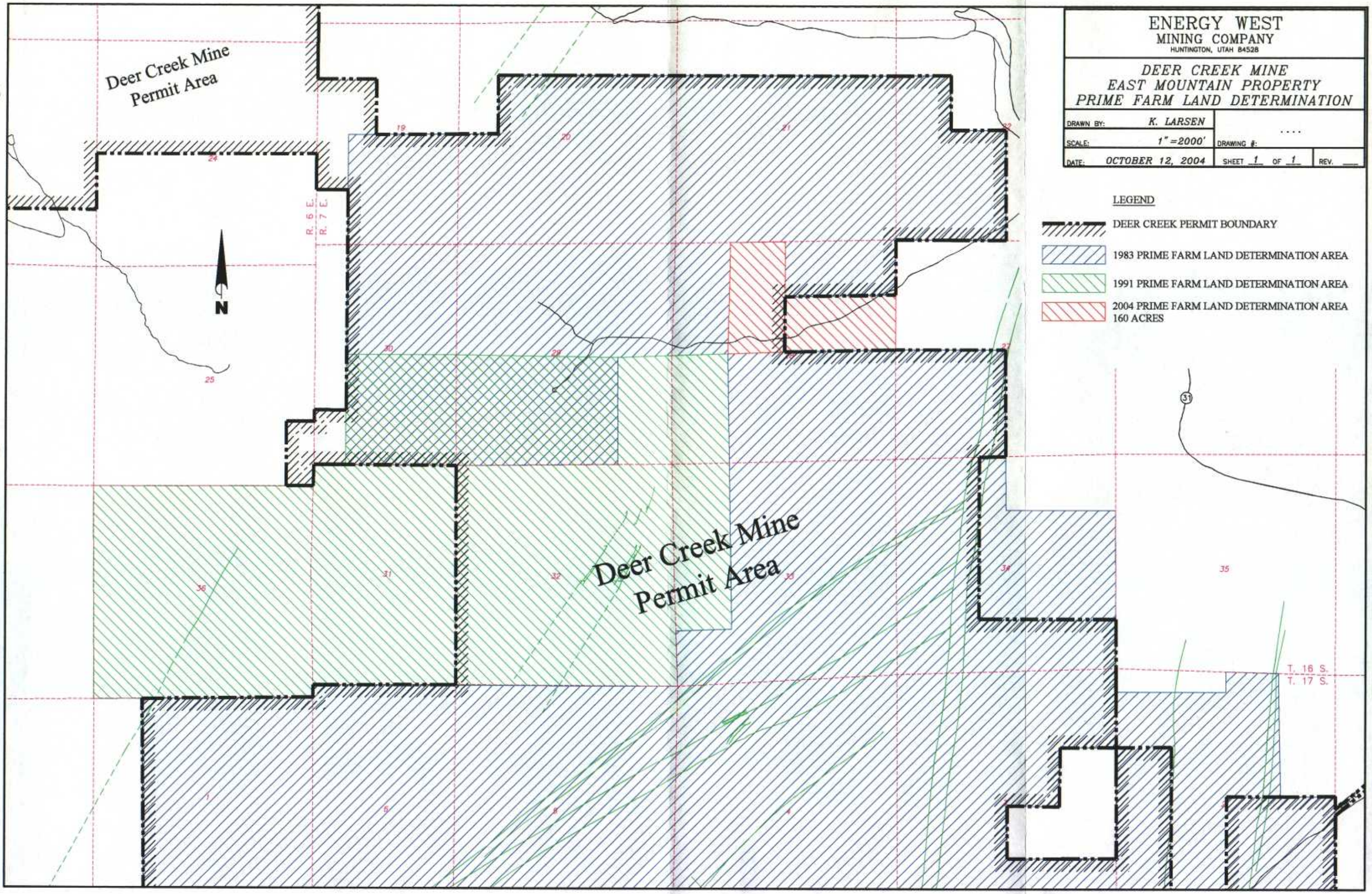
After a site visit the Natural Resources Conservation Service has determined that there are no prime farmlands in the site area because the soils contain more than 10 percent surface rock fragments or the percent slope x K (erodibility factor) exceedes 2. Also this area is above all existing irrigation systems.

If you need any further assistance please let us know.

Leland E. Sasser

Leland Sasser NRCS Soil Scientist

Cc: Michael J. Domeier NRCS State Soil Scientist
Percila Burton Utah DOGM
file


ENERGY WEST
MINING COMPANY
HUNTINGTON, UTAH 84528
DEER CREEK MINE
EAST MOUNTAIN PROPERTY
PRIME FARM LAND DETERMINATION
DRAWN BY: K. LARSEN
SCALE: 1"=2000'
DRAWING #: ....
DATE: OCTOBER 12, 2004
SHEET 1 OF 1
REV.
LEGEND
DEER CREEK PERMIT BOUNDARY
1983 PRIME FARM LAND DETERMINATION AREA
1991 PRIME FARM LAND DETERMINATION AREA
2004 PRIME FARM LAND DETERMINATION AREA
160 ACRES
Deer Creek Mine
Permit Area
Deer Creek Mine
Permit Area
N
R. 6 E.
R. 7 E.
T. 16 S.
T. 17 S.
31
19
20
21
22
24
25
30
29
27
36
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32
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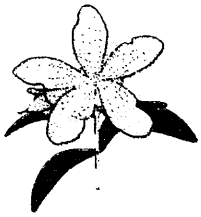
34
35
1
6
5
4

R645-301-300 BIOLOGY SECTION

APPENDIX A
VEGETATION SURVEY

♦ **NORTH RILDA CANYON PORTAL FACILITIES AREA VEGETATION SURVEY, 2004, MT. NEBO SCIENTIFIC, INC.**

PLANT COMMUNITIES OF THE NEW NORTH RILDA CANYON PORTAL FACILITIES AREA 2004



Prepared by

MT. NEBO SCIENTIFIC, INC.
330 East 400 South, Suite 6
Springville, Utah 84663
(801) 489-6937

Patrick D. Collins, Ph.D.

for

ENERGY WEST MINING COMPANY
P.O. Box 310
Huntington, Utah 84528

July 2004

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2003 RILDA CANYON STUDY . . . . . Appendix

VEGETATION MAP . . . . . Map Folder

INTRODUCTION

In 2003, Energy West Mining Company had proposed to construct a new portal facilities area in North Rilda Canyon. The preliminary plans were designed to construct the facilities east, or downstream, of a spring developed by North Emery Water Users Special Service District (NEWUSSD). In the earlier designs, most of the proposed disturbance would have been contained within those areas that had been disturbed previously by historical mining activities and later reclaimed under the direction of the State of Utah, Division of Oil, Gas & Mining (DOGM), Abandoned Mine Reclamation Program (AMR). In 2004, plans shifted and Energy West moved the proposed facilities west of the previous site, or upstream from the spring development area mentioned above.

The objective of this document is to describe the plant communities that would be impacted by the construction of the proposed new facilities in Rilda Canyon located west of the spring area. In doing so, quantitative sampling was conducted in 2004 within those plant communities that have been proposed for disturbance by construction activities. In addition to sampling plant communities that could be impacted, other plant communities were sampled that will remain undisturbed and serve as standards for final revegetation success when it is time for reclamation of the new North Rilda Canyon Portal Facilities.

Previous Study

When the aforementioned earlier site was being considered for development, plant communities that would have been impacted at this site were sampled in 2003. A final report for that area was submitted to Energy West Mining Company. Because some of the data collected from those plant communities could be appropriately used in the current studies for the new area, some of these data sets have been incorporated into this report. Additionally, with the intent to preserve data that could be used in the future, these data sets, including most of the earlier report, have been included in the Appendix of this report.

*Because data sets from both of the studies mentioned above are being used in this report, and as an attempt to clarify or make distinctions between these two data sets, the remainder of this report will refer to these two studies as either the "**2003 study**" or the "**2004 study**".*

Vegetation Mapping & Sample Locations

A vegetation map was prepared for the 2003 study. The earlier map has not been included in this report because a new map has been prepared for the 2004 study that includes the new proposed facilities area as well as the information from the earlier study. Shown on the new map are: 1) boundary of the proposed new portal facilities area (proposed disturbed areas), 2) boundary of an "expanded" study area, 3) plant communities of the proposed disturbed as well as adjacent areas, 4) plant communities of the 2003 study and adjacent areas, 5) sample locations of the 2004 study

and 6) sample locations of the 2003 study (see *"Vegetation Map of the North Rilda Canyon Portal Facilities"*).

METHODS

Methodologies used herein were performed in accordance with the guidelines supplied by DOGM. Quantitative and qualitative data were taken in the plant communities that have a potential of being impacted by the proposed construction as well as those "Reference Areas" chosen to represent standards for future revegetation success.

Sampling Design and Transect/Quadrat Placement

Transect lines for vegetation sampling were placed randomly within the boundaries of the sample areas. Once the transects were established, quadrat locations for sampling were chosen using random numbers from the transect lines with the objective to record data without preconceived bias.

Cover, Composition & Frequency

Cover estimates were made using ocular methods with meter square quadrats. Species composition, cover by species, and relative frequencies were also assessed from the quadrats. Overstory and understory cover were recorded separately therefore making it possible to have

total living cover values greater than 100 percent. Plant nomenclature follows "A Utah Flora" (Welsh et al. 2003).

Woody Species Density

Density of woody plant species for the study areas were estimated using the point-quarter method. 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. The number of individuals per acre was the end results of the calculations. (Note: although considered a shrub or "subshrub", Oregon grape (*Mahonia repens*) was not counted in the woody species densities with the thought that, if it were, this may overestimate this standard (or the intent of this standard) at the time of final revegetation.

Sample Size & Adequacy

Sampling adequacy for cover and density was attempted by using the formula given below.

where,

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

nMIN = minimum adequate sample

t = appropriate confidence t-value

s = standard deviation
x = sample mean
d = desired change from mean

With the values used for "t" and "d"above, the goal was to meet sample adequacy with 80% confidence within a 10% deviation from the true mean.

Statistical Analyses

Student's t-tests were employed to compare the total living cover and total woody species density of each proposed disturbed sites with their respective Reference Area.

Photographs

Color photographs of the sample areas were taken at the time of sampling and have been included in this report

RESULTS

Study Areas

There were four major plant communities studied for the 2004 study site at the proposed North Rilda Canyon Portal Facilities Area. These communities were: 1) Proposed Disturbed - White

Fir/Aspen, 2) Reference Area - White Fir/Aspen, 3) Proposed Disturbed - Sagebrush/Grass, and 4) Proposed Disturbed - Pinyon-Juniper/Mountain Brush (see *"Vegetation Map of the North Rilda Canyon Portal Facilities"*). The White Fir/Aspen communities were located on the more flat areas near the bottom of the canyon and were somewhat close to the creek that runs down Rilda Canyon. When one moves upward in elevation to the more open areas on alluvial soils, the areas were mostly comprised of a Sagebrush/Grass community. Finally, as one continues to move up a little more in elevation, the area supported a Pinyon-Juniper/Mountain Brush community (a transitional plant community). More specifically, this community could be considered a Pinyon-Juniper/Curl-leaf Mountain Mahogany/Ponderosa Pine community as the vegetation map included indicates.

The approximate GPS coordinates of the communities studied for the 2004 report are given below.

Community Type	Zone	UTM Easting (approximate)	UTM Northing (approximate)	USGS 7.5 Min. Quad. Map
White Fir/ Aspen (Proposed Disturbed)	12	0486688	4361377	Rilda Canyon
White Fir/ Aspen (Reference Area)	12	0486389	4361288	Rilda Canyon
Sagebrush/Grass (Proposed Disturbed)	12	0486781	4361366	Rilda Canyon
Pinyon-Juniper/Mtn. Brush (Proposed Disturbed)	12	0486577	4361405	Rilda Canyon

Of the three plant communities that could be affected by the proposed new facilities, two of them had very similar plant communities as were sampled for the previous 2003 study – the Sagebrush/Grass and the Pinyon-Juniper/Mountain Brush communities. Because DOGM

requires that the *site-specific* data be taken from those areas proposed for disturbance, even though these community types were sampled for the previous study, more data were recorded from the new site location. Nevertheless, during the previous study Reference Areas were chosen to represent future standards of revegetation success. Some of these same Reference Areas will be used to represent standards for areas proposed for disturbance at the new site.

There was one vegetation type that existed in the 2004 study site that had not been sampled in the 2003 study. This type was the White Fir/Aspen community. As a result, not only was the proposed disturbance of this community sampled, but a new Reference Area was chosen and sampled to be compared with it.

Proposed Disturbed - White Fir/Aspen

Table 1 shows the results of the summarized cover data including cover by species (overstory and understory), total cover, composition, and frequency for the proposed disturbed White Fir/Aspen community for the 2004 study. In this community, overstory was dominated by aspen (*Populus tremuloides*) and white fir (Abies *concolor*). The dominate understory species were: Oregon grape (*Mahonia repens*), white fir, and common juniper (*Juniperus communis*). Refer to Table 1-A for cover by species.

The total living overstory cover was estimated at 56.38%, whereas, understory cover was nearly as high at 47.50% (Table 1-B). Cover values for litter, bareground, rock and combined living

cover (overstory plus understory) were also given on Table 1-B.

The species composition for understory cover was dominated by woody species at 76.10%, followed by grasses at 14.90% and forbs at 9.00% (Table 1-C).

Woody species densities are shown on Table 7. The total number or individuals per acre was 2,647 plants. The dominate species for this parameter were white fir and aspen.

Reference Area - White Fir/Aspen

Cover, composition and frequency values of the 2004 study for the Reference Area for the White Fir/Aspen community are shown on Table 2. The overstory of this community was dominated by blue spruce (*Picea pungens*) and aspen (Table 2-A). Like the proposed disturbed area it was chosen to represent for comparisons, two of the dominate understory species were Oregon grape and white fir.

The total living overstory cover was estimated at 55.33% and understory was 54.33% (Table 2-B). The species composition was dominated by woody species followed by grasses and forbs at 86.18%, 8.19% and 5.63%, respectively (Table 2-C).

Total density of woody species was 2,611 individuals per acre and was dominated by aspen and white fir (Table 8).

Proposed Disturbed - Sagebrush/Grass

Cover, frequency and composition values in the 2004 study for the Proposed Disturbed Sagebrush/Grass community have been listed on Table 3. As shown on Table 3-A, the dominate species by far was big sagebrush (*Artemisia tridentata*), followed by needle-and-thread grass (*Stipa comata*), then slender wheatgrass (*Elymus trachycaulus*).

Total living cover of this community was 52.33%, of which 50.17% was understory and only 2.17% was overstory (Table 3-B). Although shrubs dominated the species composition at 52.38%, grasses were not too far behind at 39.09% (Table 3-C).

Woody species density values totaled 3,996 individuals per acre (Table 9) and was dominated by big sagebrush and rubber rabbitbrush (*Chrysothamnus nauseosus*).

Reference Area - Sagebrush/Grass

The cover of Reference Area chosen to represent the standards for the proposed disturbed area after it has been reclaimed was dominated by big sagebrush, Sandberg's bluegrass (*Poa secunda*) and needle-and-thread grass (Table 4-A). In the 2003 study, the total living cover was estimated at 57.50% (Table 4-B). Grasses dominated the species composition at 47.83%, but was by quite a narrow margin with shrubs following at 39.29%, then forbs at 12.88% (Table 4-C). Woody species density total was 4,045 individuals per acre (Table 10).

Proposed Disturbed - Pinyon-Juniper/Mountain Brush

Overstory and understory cover values for the 2004 study of the Proposed Disturbed Pinyon-Juniper/Mountain Brush community are shown on Table 5-A. Ponderosa pine (*Pinus ponderosa*), curl-leaf mountain mahogany (*Cercocarpus ledifolius*), and white fir dominated the overstory cover. The species that dominated the understory cover were Oregon grape and Salina wildrye (*Elymus salinus*).

Species composition, as expected, was dominated by woody plants at 73.89% of the cover, followed by grasses at 25.26% and forbs at 0.85% (Table 5-C).

Woody species densities are shown on Table 11. The total number of individuals per acre was 995 plants.

Reference Area - Pinyon-Juniper/Mountain Brush

Taken from the 2003 study, Table 6-A shows the overstory cover for the Reference Area of the Pinyon-Juniper/Mountain Brush community was dominated by curl-leaf mountain mahogany, followed by Utah Juniper (*Juniperus osteosperma*) and pinyon pine (*Pinus edulis*). Understory dominants were Salina wildrye, curl-leaf mountain mahogany and pinyon pine.

Total living cover was 63.83% (Table 6-B), of which 25.17% was overstory and 38.67% was

understory. Grasses dominated the cover with a composition value at 53.31%, while shrubs were 45.48% and forbs 1.22% (Table 6-C).

Density, or the total number of woody plants per acre was estimated at 946 plants per acre (Table 12). The species with the greatest densities were curl-leaf mountain mahogany, Utah juniper, and pinyon pine.

Threatened, Endangered or Sensitive Species

There was a potential of the following plants to be present in the study areas: canyon sweetvetch (*Hedysarum occidentale* var. *canone*) and Link Trial columbine (*Aquilegia flavescens* var. *rubicunda*). These plants have been listed as "sensitive" in the Manti-La Sal National Forest by the USDA Forest Service. These plants, including ideal habitat for these plants, were not found during the plant surveys.

SUMMARY & CONCLUSIONS

Plant communities that would be impacted by proposed new construction of the portal facilities in North Rilda Canyon were quantitatively sampled. Additionally, similar communities chosen outside the areas that would be disturbed were also sampled. The later areas were called Reference Areas and will be used for comparisons at the time of final reclamation for revegetation success standards. Data from the Reference Areas were also compared at this time employing

statistics to determine whether or not the Reference Areas should be deemed "representative" of the plant community of which they were chosen to represent in the future

Figures 1 through 3 statistically compare the total living covers and woody species densities of each area proposed for disturbance with its representative Reference Area. The figures illustrate that *Student's t-tests suggest no significant differences for cover and woody species densities when the proposed disturbed areas were compared to the Reference Areas.* In other words, each Reference Area chosen to represent a specific area proposed for disturbance, should be an appropriate community to provide standards for final revegetation success.

SUMMARY TABLES
(Of the Quantitative Data)

Table 1: Cover by Species, Frequency, Total Cover, and Composition.
Rilda Canyon New Facilities Area (West).
Proposed Disturbed White Fir/Aspen (2004).

A. COVER BY SPECIES (%)	Mean	SDev	Freq
OVERSTORY			
Abies concolor	16.88	30.39	32.50
Juniperus scopulorum	1.00	6.24	2.50
Picea pungens	7.63	20.98	15.00
Pinus ponderosa	3.25	14.34	5.00
Populus angustifolia	1.13	4.94	5.00
Populus tremuloides	20.50	21.85	52.50
Pseudotsuga menziesii	6.00	18.24	12.50
UNDERSTORY			
SHRUBS			
Abies concolor	7.00	11.03	47.50
Acer glabrum	0.13	0.78	2.50
Artemisia tridentata	1.00	4.77	7.50
Chrysothamnus viscidiflorus	0.13	0.78	2.50
Juniperus communis	6.93	15.23	22.50
Juniperus scopulorum	0.75	3.27	5.00
Mahonia repens	13.03	13.93	62.50
Pachistma myrsinites	3.13	7.80	22.50
Picea pungens	1.83	5.62	12.50
Pinus ponderosa	0.13	0.78	2.50
Populus angustifolia	0.13	0.78	2.50
Populus tremuloides	1.45	3.08	20.00
Rosa woodsii	1.13	3.44	12.50
Symphoricarpos oreophilus	0.13	0.78	2.50
FORBS			
Antennaria microphylla	2.20	5.79	15.00
Circium sp.	0.13	0.78	2.50
Cynoglossum officinale	0.25	1.09	5.00
Galium bifolium	0.45	1.28	12.50
Lathrus lanszwertii	0.13	0.78	2.50
Melilotus officinalis	0.08	0.47	2.50
Taraxicum officinale	0.05	0.31	2.50
Viola adunca	0.83	2.06	17.50
GRASSES			
Elymus salinus	0.75	2.63	7.50
Elymus trachycaulus	2.30	5.10	22.50
Poa fendleriana	3.50	6.44	35.00
B. TOTAL COVER (%)			
Overstory (O)	56.38	28.68	
Understory (U)	47.50	17.03	
Litter	41.68	21.13	
Bareground	7.65	12.05	
Rock	3.18	5.36	
O + U	103.88	24.74	
C. COMPOSITION (%)			
Trees & Shrubs	76.10	24.44	
Forbs	9.00	14.65	
Grasses	14.90	16.99	

Table 2: Cover by Species, Frequency, Total Cover, and Composition.
Rilda Canyon New Facilities Area (West).
Reference Area - White Fir/ Aspen (2004).

A. COVER BY SPECIES (%)	Mean	SDev	Freq
OVERSTORY			
Abies concolor	4.17	14.38	10.00
Picea pungens	29.00	35.08	50.00
Populus angustifolia	2.67	9.98	6.67
Populus tremuloides	19.50	26.34	40.00
UNDERSTORY			
SHRUBS			
Abies concolor	7.27	13.15	30.00
Acer glabrum	2.07	4.27	20.00
Amalanchier utahensis	0.17	0.90	3.33
Artemisia tridentata	0.33	1.80	3.33
Juniperus scopulorum	0.17	0.90	3.33
Mahonia repens	24.50	12.61	96.67
Pachistma myrsinites	2.83	4.60	33.33
Picea pungens	1.33	4.46	10.00
Populus tremuloides	3.73	5.02	40.00
Ribes aureum	0.17	0.90	3.33
Rosa woodsii	2.43	4.51	26.67
Rubus idaeus	0.33	1.80	3.33
Symphoricarpos oreophilus	1.17	4.78	6.67
FORBS			
Achillea millefolium	0.17	0.90	3.33
Galium bifolium	1.00	2.00	20.00
Lathrus lanszwertii	0.17	0.90	3.33
Osmorhiza depauperata	1.33	2.56	23.33
Viola adunca	0.50	1.50	10.00
GRASSES			
Poa fendleriana	1.67	2.98	26.67
Elymus trachycaulus	1.67	4.89	16.67
Poa pratensis	1.33	5.15	6.67
B. TOTAL COVER (%)			
Overstory (O)	55.33	38.23	
Understory (U)	54.33	15.21	
Litter	40.67	15.21	
Bareground	3.40	0.99	
Rock	1.60	0.99	
O + U	109.67	35.59	
C. COMPOSITION (%)			
Trees & Shrubs	86.18	14.65	
Forbs	5.63	6.88	
Grasses	8.19	12.72	

Table 3: Cover by Species, Frequency, Total Cover, and Composition.
Rilda Canyon New Facilities Area (West).
Proposed Disturbed Sagebrush/Grass (2004).

A. COVER BY SPECIES (%)	Mean	SDev	Freq
OVERSTORY			
Juniperus osteosperma	1.83	6.89	6.67
Pinus ponderosa	0.33	1.80	3.33
UNDERSTORY			
SHRUBS			
Abies concolor	0.43	1.33	10.00
Artemisia tridentata	13.33	12.47	70.00
Atriplex canescens	1.33	7.18	3.33
Chrysothamnus nauseosus	5.73	8.92	46.67
Gutierrezia sarothrae	0.67	1.70	13.33
Juniperus osteosperma	1.33	4.82	10.00
Mahonia repens	1.47	3.66	16.67
Pinus edulis	1.67	8.98	3.33
Rosa woodsii	0.67	2.13	10.00
Symphoricarpos oreophilus	0.17	0.90	3.33
FORBS			
Antennaria microphylla	1.33	3.64	13.33
Artemisia ludoviciana	0.93	1.90	20.00
Circium sp.	0.43	1.86	6.67
Cynoglossum officinale	0.57	1.73	10.00
Descurainia pinnata	0.17	0.90	3.33
Lappula occidentalis	1.00	2.38	20.00
GRASSES			
Bromus tectorum	0.17	0.90	3.33
Elymus salinus	3.67	6.94	20.00
Elymus smithii	0.67	2.81	6.67
Elymus trachycaulus	6.93	6.66	63.33
Stipa comata	7.50	12.50	43.33
B. TOTAL COVER (%)			
Overstory (O)	2.17	7.03	
Understory (U)	50.17	12.35	
Litter	20.17	12.48	
Bareground	14.77	12.78	
Rock	14.90	15.48	
O + U	52.33	10.86	
C. COMPOSITION (%)			
Trees & Shrubs	52.38	23.71	
Forbs	8.53	9.95	
Grasses	39.09	23.21	

Table 4. Cover by Species, Frequency, Total Cover, and Composition.
Rilda Canyon New Facilities Area (East).
Reference Area Sagebrush/Grass Community (2003).

A. COVER BY SPECIES	Mean	SDev	Freq
TREES & SHRUBS			
Artemisia tridentata	14.37	13.65	70.00
Chrysothamnus nauseosus	6.07	8.79	43.33
Juniperus osteosperma	0.50	2.69	3.33
Opuntia polyacantha	0.17	0.90	3.33
Rosa woodsii	1.07	2.83	13.33
Symphoricarpos oreophilus	1.17	4.60	10.00
FORBS			
Artemisia dracunculus	0.50	2.69	3.33
Circium sp.	0.17	0.90	3.33
Cynoglossum officinale	1.57	3.44	23.33
Erigeron sp.	0.33	1.80	3.33
Lepidium perfoliatum	0.67	1.70	13.33
Machaeranthera canescens	0.33	1.25	6.67
Taraxicum officinale	3.27	6.36	30.00
GRASSES			
Elymus salinus	4.17	10.25	16.67
Elymus trachycaulus	0.33	1.80	3.33
Elymus trachycaulus	0.17	0.90	3.33
Poa fendleriana	1.83	6.39	10.00
Poa secunda	13.50	13.85	60.00
Stipa comata	7.33	12.76	33.33
B. TOTAL COVER			
Total Living Cover	57.50	11.88	
Litter	30.33	10.95	
Bareground	7.73	8.21	
Rock	4.43	5.74	
C. COMPOSITION			
Trees & Shrubs	39.29	20.54	
Forbs	12.88	16.00	
Grasses	47.83	17.22	

Table 5: Cover by Species, Frequency, Total Cover, and Composition.
Rilda Canyon New Facilities Area (West).
Proposed Disturbed Pinyon-Juniper/Mountain Brush (2004).

A. COVER BY SPECIES (%)	Mean	SDev	Freq
OVERSTORY			
Abies concolor	5.33	16.12	16.67
Cercocarpus ledifolius	5.67	13.40	20.00
Juniperus osteosperma	4.33	14.01	10.00
Juniperus scopulorum	1.17	6.28	3.33
Pinus edulis	1.50	8.08	6.67
Pinus ponderosa	6.17	15.53	16.67
Pseudotsuga menziesii	2.00	6.00	10.00
UNDERSTORY			
SHRUBS			
Abies concolor	1.83	5.84	6.67
Artemisia tridentata	1.67	5.06	13.33
Cercocarpus ledifolius	1.17	4.78	6.67
Chrysothamnus nauseosus	1.33	3.14	16.67
Guiterrezia sarothrae	0.50	1.98	6.67
Juniperus osteosperma	1.83	4.74	16.67
Juniperus scopulorum	1.67	6.75	6.67
Mahonia repens	6.00	7.90	46.67
Pinus edulis	2.00	7.48	6.67
Pseudotsuga menziesii	1.00	5.39	3.33
Symphoricarpos oreophilus	0.17	0.90	3.33
FORBS			
Erigeron sp.	0.27	0.81	10.00
GRASSES			
Elymus salinus	5.23	6.21	60.00
Elymus trachycaulus	0.50	1.98	6.67
Stipa comata	0.17	0.90	3.33
Stipa hymenoides	0.50	2.69	3.33
B. TOTAL COVER (%)			
Overstory (O)	26.17	25.48	
Understory (U)	25.83	11.48	
Litter	31.33	22.38	
Bareground	15.63	17.10	
Rock	27.20	19.00	
O + U	52.00	24.34	
C. COMPOSITION (%)			
Trees & Shrubs	73.89	26.58	
Forbs	0.85	2.63	
Grasses	25.26	26.63	

Table 6. Cover by Species, Frequency, Total Cover, and Composition.
Rilda Canyon New Facilities Area (East).
Reference Area Pinyon-Juniper/Mtn. Brush Community (2003).

A. COVER BY SPECIES	Mean	SDev	Freq
OVERSTORY			
Cercocarpus ledifolius	14.27	24.38	30.00
Juniperus osteosperma	4.73	12.34	13.33
Pinus edulis	3.67	11.47	10.00
Pinus ponderosa	2.50	13.46	3.33
UNDERSTORY			
TREES & SHRUBS			
Cercocarpus ledifolius	4.50	9.16	26.67
Eriogonum corymbosum	0.60	2.73	6.67
Euphorbia fendleri	0.17	0.90	3.33
Gutierrezia sarothrae	1.50	4.06	20.00
Juniperus osteosperma	2.60	7.77	13.33
Mahonia repens	0.93	1.73	26.67
Pinus edulis	4.50	11.86	16.67
Rhus simplicifolia	3.83	13.02	10.00
FORBS			
Artemisia dracunculus	0.07	0.36	3.33
Erigeron sp.	0.27	1.03	6.67
Phlox sp.	0.17	0.90	3.33
GRASSES			
Elymus salinus	18.20	15.90	83.33
Poa secunda	0.17	0.90	3.33
Stipa hymenoides	1.17	3.08	13.33
B. TOTAL COVER			
Overstory (O)	25.17	27.67	
Understory (U)	38.67	14.02	
Litter	19.50	19.59	
Bareground	14.10	10.40	
Rock	27.73	16.81	
O + U	63.83	30.54	
C. COMPOSITION			
Trees & Shrubs	45.48	33.79	
Forbs	1.22	4.67	
Grasses	53.31	33.40	

Table 7. Woody Species Density. Rilda Canyon New Facilities Area (West). Proposed Disturbed White Fir/Aspen (2004).	
	No/Ac
Abies concolor	976.05
Acer glabrum	49.63
Artemisia tridentata	99.26
Ceratoides lanata	66.17
Chrysothamnus nauseosus	16.54
Juniperus communis	330.87
Juniperus scopulorum	148.89
Picea pungens	99.26
Pinus ponderosa	16.54
Populus angustifolia	49.63
Populus tremuloides	628.64
Pseudotsuga menziesii	66.17
Rosa woodsii	82.72
Symphoricarpos oreophilus	16.54
Total	**2646.93**

Table 8. Woody Species Density. Rilda Canyon New Facilities Area (West). Reference Area - White Fir/Aspen (2004).	
	No/Ac
Abies concolor	652.81
Acer glabrum	195.84
Amelanchier utahensis	21.76
Juniperus scopulorum	21.76
Picea pungens	195.84
Pinus ponderosa	43.52
Populus angustifolia	21.76
Populus tremuloides	979.21
Pseudotsuga menziesii	21.76
Rosa woodsii	326.40
Symphoricarpos oreophilus	130.56
Total	**2611.23**

Table 9. Woody Species Density. Rilda Canyon New Facilities Area (West). Proposed Disturbed Sagebrush/Grass (2004).	
	No/Ac
Artemisia nova	33.30
Artemisia tridentata	1964.50
Atriplex canescens	33.30
Ceratoides lanata	66.59
Chrysothamnus nauseosus	1098.79
Gutierrezia sarothrae	366.26
Juniperus scopulorum	166.48
Opuntia polyacantha	33.30
Pinus edulis	33.30
Rosa woodsii	133.19
Symphoricarpos oreophilus	66.59
Total	**3995.59**

Table 10. Woody Species Density. Rilda Canyon New Facilities Area (East). Reference Area. Sagebrush/Grass Community (2003).	
	No/Ac
Artemisia tridentata	2190.83
Chrysothamnus nauseosus	1112.27
Populus tremuloides	101.12
Rosa woodsii	438.17
Symphoricarpos oreophilus	202.23
Total	**4044.61**

Table 11. Woody Species Density. Rilda Canyon New Facilities Area (West). Proposed Disturbed Pinyon-Juniper/Mtn. Brush (2004).	
	No/Ac
Abies concolor	149.21
Artemisia tridentata	149.21
Cercocarpus ledifolius	82.89
Chrysothamnus nauseosus	107.76
Gutierrezia sarothrae	41.45
Juniperus osteosperma	174.07
Juniperus scopulorum	116.05
Pinus edulis	66.31
Pinus ponderosa	41.45
Pseudotsuga menziesii	8.29
Rhus aromatica	8.29
Rosa woodsii	16.58
Symphoricarpos oreophilus	33.16
Total	**994.70**

Table 12. Woody Species Density. Rilda Canyon New Facilities Area (East). Reference Area Pinyon-Juniper/Mtn. Brush (2003).	
	No/Ac
Artemisia tridentata	15.76
Cercocarpus ledifolius	228.52
Chrysothamnus nauseosus	23.64
Chrysothamnus viscidiflorus	7.88
Eriogonum corymbosum	39.40
Gutierrezia sarothrae	126.08
Juniperus osteosperma	157.60
Juniperus scopulorum	7.88
Mahonia repens	94.56
Opuntia polyacantha	7.88
Pinus edulis	133.96
Pinus ponderosa	7.88
Pseudotsuga menziesii	7.88
Rhus aromatica	78.80
Symphoricarpos oreophilus	7.88
Total	**945.59**

FIGURES
(Statistical Comparisons)

FIG. 1. WHITE FIR/ASPEN - Statistical comparisons (Student's t-tests) between the Proposed Disturbed Area and Reference Areas in North Rilda Canyon.

	$\bar{x}$	s	n	t	df	SL
TOTAL LIVING COVER *						
Proposed Disturbed:	103.88	24.74	40			
Reference Area:	109.67	35.59	30			
t-test				-0.803	68	ns
WOODY SPECIES DENSITY						
Proposed Disturbed:	2646.93	1210.12	40			
Reference Area:	2611.23	1003.53	30			
t-test				0.131	68	ns

* = includes overstory plus understory cover
$\bar{x}$ = mean
s = standard deviation
n = sample size
t = Student's t-value
df = degrees of freedom
SL= Significance Level
ns = non-significant at .05 or below.

FIG. 2. SAGEBRUSH/GRASS - Statistical comparisons (Student's t-tests) between the Proposed Disturbed Area and Reference Areas in North Rilda Canyon.

	$\bar{x}$	s	n	t	df	SL
TOTAL LIVING COVER *						
Proposed Disturbed:	52.33	10.86	30			
Reference Area:	57.50	11.88	30			
t-test				1.759	58	ns
WOODY SPECIES DENSITY						
Proposed Disturbed:	3995.59	1712.34	30			
Reference Area:	4044.61	1400.60	30			
t-test				-0.121	58	ns

* = includes overstory plus understory cover
$\bar{x}$ = mean
s = standard deviation
n = sample size
t = Student's t-value
df = degrees of freedom
SL= Significance Level
ns = non-significant at .05 below

FIG. 3. PINYON-JUNIPER/MOUNTAIN BRUSH - Statistical comparisons (Student's t-tests) between the Proposed Disturbed Area and Reference Areas in North Rilda Canyon.

	$\bar{x}$	s	n	t	df	SL
TOTAL LIVING COVER *						
Proposed Disturbed:	52.00	24.34	30			
Reference Area:	63.83	30.54	30			
t-test				-1.659	58	ns
WOODY SPECIES DENSITY						
Proposed Disturbed:	994.70	531.72	30			
Reference Area:	945.59	759.42	30			
t-test				0.290	58	ns

* = includes overstory plus understory cover
$\bar{x}$ = mean
s = standard deviation
n = sample size
t = Student's t-value
df = degrees of freedom
SL= Significance Level
ns = non-significant at 0.05 or below

COLOR PHOTOGRAPHS
(Of the Sample Areas)

Proposed Disturbed White Fir/ Aspen Community in Rilda Canyon (2004).

Reference Area White Fir/ Aspen Community in Rilda Canyon (2004).

Proposed Disturbed Sagebrush Community in Rilda Canyon (2004).

Reference Area Sagebrush/Grass Community in Rilda Canyon (2003).

Proposed Disturbed Pinyon-Juniper/Mtn. Brush Community in Rilda Canyon (2004).

Reference Area Pinyon-Juniper/ Mtn. Brush Community in Rilda Canyon (2003).

APPENDIX

(2003 Rilda Canyon Study)

PLANT COMMUNITIES
OF THE
NORTH RILDA CANYON
PORTAL FACILITIES AREA
2003

Prepared by

MT. NEBO SCIENTIFIC, INC.
330 East 400 South, Suite 6
Springville, Utah 84663
(801) 489-6937

Patrick D. Collins, Ph.D.

for

ENERGY WEST MINING COMPANY
P.O. Box 310
Huntington, Utah 84528

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INTRODUCTION

Rilda Canyon, a tributary of Huntington Canyon in Emery County, Utah, has a long history of coal mining operations. Reclamation and revegetation of some of the old coal mine areas in Rilda Canyon was accomplished under the direction of the State of Utah, Division of Oil, Gas & Mining, Abandoned Mine Reclamation Program (AMR). More recently, Energy West Mining Company constructed a fan and portal in Rilda Canyon for their Deer Creek Mine.

Energy West is currently proposing to construct additional facilities for mining operations in Rilda Canyon. The proposed new area is to be called the "North Rilda Canyon Portal Facilities". Most of the proposed new facilities will be constructed in those areas that have been previously disturbed by past mining operations and later reclaimed by the AMR program.

The objective of this document is to describe the plant communities that would be impacted by the construction of the proposed facilities in Rilda Canyon. In preparation for this report quantitative sampling was conducted in these plant communities during the growing season of 2003. In addition to sampling the plant communities that are proposed for disturbance, other plant communities were sampled that will remain undisturbed and serve as standards for final revegetation success when it is time for reclamation of the North Rilda Canyon Portal Facilities.

The Study Sites

A total of 11 vegetation study areas were sampled for the study (see Map 1). The study areas, plant community names, UTM map coordinates, and USGS maps where they can be located are listed below on Table 1.

Table 1: Study Sites - Plant Communities, Map Coordinates and Quadrangle Maps.

No.	Site Name	Zone	UTM Easting Coordinate	UTM Northing Coordinate	USGS 7.5 Min. Quad. Map
1	**Main Facilities Area.** Proposed Disturbed. Pinyon-Juniper/Mtn. Brush (Previous Disturbed and AMR Reclamation Area).	12 12	0487573 1487280	4361349 4361322	Rilda Canyon
2	**Main Facilities Area.** Reference Area. Pinyon-Juniper/Mtn. Brush (Previous Disturbed and AMR Reclamation Area).	12	0487091	4361212	Rilda Canyon
3	**Main Facilities Area.** Proposed Disturbed. Pinyon-Juniper/Mtn. Brush (Undisturbed).	12	~0487082	~4361359	Rilda Canyon
4	**Main Facilities Area.** Reference Area. Pinyon-Juniper/Mtn. Brush (Undisturbed).	12	0487872	4361363	Rilda Canyon
5	**Main Facilities Area.** Proposed Disturbed. Riparian Community. (Undisturbed).	12	~0487473	~4361291	Rilda Canyon
6	**Main Facilities Area.** Reference Area. Riparian Community (Undisturbed).	12	0487614	4361309	Rilda Canyon
7	**Leachfield Area** Proposed Disturbed Sagebrush/Grass (Undisturbed)	12	0488144	4361488	Rilda Canyon
8	**Leachfield Area** Reference Area Sagebrush/Grass (Undisturbed).	12	0487875	4361300	Rilda Canyon
9	**Upper Borrow Area** Proposed Disturbed. Sagebrush/Grass (Scattered Pinyon-Juniper) (Undisturbed)	12 12	0488851 1488578	4361782 4361712	Rilda Canyon
10	**Lower Borrow Area** Proposed Disturbed. Pinyon-Juniper/Mtn. Brush (Undisturbed).	12	0489375	4362254	Hiawatha
11	**Lower Borrow Area** Proposed Disturbed. Sagebrush/Grass. (Undisturbed)	12	0489134	4362046	Rilda Canyon

METHODS

Methodologies used herein were performed in accordance with the guidelines supplied by the State of Utah, Division of Oil, Gas and Mining (DOGM). Quantitative and qualitative data were taken in the plant communities that have a potential of being impacted by the proposed operations as well as those "Reference Areas" chosen to represent standards for future revegetation success.

Sampling Design and Transect/Quadrat Placement

Transect lines for vegetation sampling were placed randomly within the boundaries of the sample area. Once the transects were established, quadrat locations for sampling were chosen using random numbers from the transect lines with the objective to record data without preconceived bias.

Cover and Composition

Cover estimates were made using ocular methods with meter square quadrats. Species composition, cover by species, and relative frequencies were also assessed from the quadrats. Plant nomenclature follows "A Utah Flora" (Welsh et al., 1993).

Woody Species Density

Density of woody plant species for the study areas were estimated using the point-quarter method. 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. The number of individuals per acre was the end results of the calculations.

Sample Size & Adequacy

Sampling adequacy for cover and density was attempted by using the formula given below.

where,

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

nMIN = minimum adequate sample
t = appropriate confidence t-value

s = standard deviation
x = sample mean
d = desired change from mean

With the values used for "t" and "d"above, the goal was to meet sample adequacy with 80% confidence within a 10% deviation from the true mean. In areas where sample viability was unnaturally high (e.g. previous disturbance sites), these parameters may have been too rigorous.

Statistical Analyses

Student's t-tests were employed to compare the total living cover and total woody species density of each proposed disturbed sites with their respective Reference Area.

Photographs

Color photographs of the sample areas were taken at the time of sampling and have been included with this report.

RESULTS

Because of the extensive data sets and the number of sites sampled for the study, it was believed that the best method to present the sample results was to show summarized data tables for each site (Tables 2 through 23). However, brief descriptions of the sample results have also been provided below for each area. Color photographs of each sample area have also been provided with this report.

Main Facilities Area

The Main Facilities Area as considered for this report is the area located on the most westerly section of the study area (Map 1). It is where most of the disturbance for the North Rilda Canyon Portal Facilities has been proposed.

There were three major plant community types sampled and described within the boundaries of the areas proposed for disturbance in the Main Facilities Area including: 1) previous disturbed Pinyon-Juniper/Mountain Brush (AMR), 2) undisturbed Pinyon-Juniper/Mountain Brush and 3) Riparian. Reference Areas chosen to represent future revegetation standards were also sampled.

Pinyon-Juniper/Mountain Brush (AMR)

In its natural, unaltered condition, this proposed disturbed area was once a transitional zone between a Pinyon-Juniper and a Mountain Brush community. It is one of the areas where previous historical mining activities have been conducted, followed later by AMR revegetation activities. The dominate plants according to cover and frequency measurements were: Western wheatgrass (*Elymus smithii*), thickspike wheatgrass (*E. lanceolatus*), mountain brome (*Bromus carinatus*) and rubber rabbitbrush (*Chrysothamnus nauseous*). For a list of all species present in the sample quadrats shown by cover and frequency, refer to Table 2 (A). Total living cover of this community was estimated at 42.33% [Table 2(B)]. The most important lifeform by species composition were grasses [Table 2(C)]. Density of woody species for this community was estimated at 1,286 individuals per acre (Table 13).

In an effort to disturb fewer acres in the native plant communities of the area, the mining company's construction plans were designed to utilize much of those areas that have been previously disturbed by mining (AMR sites). Because most of these areas were used in their plans for proposed new mining activities, a Reference Area that was very similar to those areas to be disturbed was difficult to find. There was an area, however, on the opposite side of Rilda Canyon Creek that had a similar history. The area had a somewhat different exposure and the species composition of its native, predisturbance plant community was probably different, but nonetheless it seemed to be the best choice for a Reference Area for the proposed disturbed Pinyon-Juniper/Mountain Brush (AMR) areas.

One of the most common species in this community was alfalfa (*Medicago sativa*). Other dominant species of this area were the same as the proposed disturbed community, such as Western wheatgrass, thickspike wheatgrass, and mountain brome [Table 3(A)]. Total living cover for this Reference Area was 52.33% [Table 3(B)] and grasses were the dominant lifeform [Table 3C)]. Unlike the proposed disturbed area it has been chosen to represent, results from sampling the number of woody species were estimated at only 178 plants per acre (Table 14).

Pinyon-Juniper/Mountain Brush (undisturbed)

Also located in the Main Facilities Area were some areas that had not been disturbed previously by historical mining operations. Because final revegetation standards should be different than those of the previously disturbed areas, these undisturbed plant communities were sampled separately. The total living cover of the proposed disturbed Pinyon-Juniper/Mountain Brush (previously undisturbed) community was estimated at 54.33% [Table 4(B)]. Woody species and grasses dominated the composition [Table 4(C)]. Some of the dominant plant species were Salina wildrye (*Elymus salinus*), pinyon pine *(Pinus edulis*), Utah Juniper (*Juniperus osteosperma*) and curl-leaf mountain mahogany *(Cercocarpus ledifolius*). See Table 4(A) for cover and frequency by species. Woody species density was estimated at 863 individuals per acre (Table 15).

An undisturbed Pinyon-Juniper/Mountain Brush Reference Area was also chosen and sampled for

future revegetation success standards. Total living cover in this area was 63.83% [Table 5(B)]. The living cover was comprised of many of the same species described for the proposed disturbed community that it was chosen to represent [Table 5(A)]. Lifeform composition was also comprised mostly of grasses and woody species [Table 5C)]. Woody species density was estimated at 946 individuals per acre (Table 16).

Riparian

A Riparian community has been proposed to be disturbed by the new mining activities. The entire length of this proposed disturbance was quantitatively sampled. The mean total living cover (understory cover plus overstory cover) was estimated at 106.00% [Table 6(B)]. The composition was dominated by woody plant species [Table 6C)]. From Table 6(A) one can see the species present in the sample quadrats. The dominant species by cover and frequency were: narrowleaf cottonwood (*Populus angustifolia*), Colorado blue spruce (*Picea pungens*), and Red-osier dogwood (*Cornus sericea*). Woody species density was estimated at 1,866 plants per acre (Table 17).

A Reference Area to be used for future revegetation standards was chosen and sampled just downstream from the proposed disturbed Riparian community. The total living cover in the Riparian Reference Area was estimated at 108.00% [Table 7(B)]. Species present [Table 7(A)] and composition [Table 7(C)] were similar to those of the proposed disturbed Riparian community. Woody species density was estimated at 2,616 individuals per acre (Table 18)

Leachfield Area

The Leachfield area was located down-canyon from the Main Facilities Area (Map 1). This area supported a plant community different from those described above. The primary plant community in this area was a native, undisturbed Sagebrush/Grass community. A Reference Area was also chosen and sampled in close proximity to the proposed disturbed Sagebrush/Grass community.

Sagebrush/Grass

The Sagebrush/Grass community of the Leachfield Area was dominated by big sagebrush (*Artemisia tridentata*) and needle-and-thread grass (*Stipa comata*), but also had several other species common in the sample quadrats [Table 8(A)]. Total living cover of this plant community was 57.83% [Table 8(B)], whereas the lifeform composition was dominated by grasses [Table 8C)]. Woody species density of the area was 3,870 individuals per acre (Table 19).

The Reference Area for the Sagebrush/Grass community was dominated by similar species [Table 9(A)], had a total living cover of 57.50 [Table 9(B)] and was also dominated by grasses as shown in the lifeform composition calculations [Table (9C)]. The woody species density of this community was 4,045 plant per acre (Table 20).

Upper Borrow Area

The Upper Borrow Area was located further down the canyon from the Leachfield Area (Map 1). This area was dominated by another Sagebrush/Grass community, but had scattered pinyon pine and Utah Juniper associated with it. It was quite similar to the Sagebrush/Grass community described in the Leachfield Area, but because it was a native community and proposed for future disturbance, quantitative data were also recorded here. The Reference Area chosen for this community was the same one used for the Leachfield Area.

Sagebrush/Grass (Scattered PJ)

This community was very similar to the abovementioned Sagebrush/Grass community according to the sample results. For cover by species refer to Table 10(A), total cover Table 10(B) and composition Table 10(C). Woody species measurements are shown on Table 21.

As mentioned, the Sagebrush/Grass Reference Area described above for the Leachfield will also be used for final revegetation standards of success. Again, refer to Table 9(A) for cover by species, Table 9(B) for total cover, Table 9C) for composition, and Table 20 for woody species density for this reference area.

Lower Borrow Area

Finally, and still further down the canyon, another area that has the potential to be used as a soil borrow area, supports an undisturbed Pinyon-Juniper/Mountain Brush transitional plant community as well as a Sagebrush/Grass community (Map 1). Sample results for these area are described below.

Pinyon-Juniper/Mountain Brush

Like the Main Facilities Area, another undisturbed Pinyon-Juniper/Mountain Brush community has been proposed for the possibility of disturbance by future mining activities. This area was also sampled for the scope of this study. The dominant plant species were pinyon pine, curl-leaf mountain mahogany, Salina wildrye and Utah Juniper [Table 11(A)]. Total living cover for this area was 51.50% [Table 11(B)]. The lifeform composition was dominated by woody species, but was followed relatively closely by grasses [Table 11(C)] . Woody species density was estimated at 1,157 plants per acre (Table 22).

The Reference Area to be used for this area is the same one described above for the Pinyon-Juniper/Mountain Brush community in the Main Facilities Area. For data summaries refer to Table 5 (A-C) and Table 16.

Sagebrush/Grass

Like the Leachfield and Upper Borrow Area described above, the Lower Reference Area also supported a native, undisturbed Sagebrush/Grass community. Because it has been proposed for potential future disturbance, it was also sampled. As before, big sagebrush and needle-and-thread grass dominated this area [Table 12(A)]. Total living cover was 46.00% [Table 12(B)]. Lifeform composition proportions showed shrubs dominated followed closely by grasses [Table 12(C)]. Woody species density was estimated at 2,762 plants per acre (Table 23).

The Sagebrush/Grass Reference Area described above for the Leachfield and Upper Borrow Area will also be used for final revegetation standards of success. Refer to Table 9(A) for cover by species, Table 9(B) for total cover, Table 9C) for composition, and Table 20 for woody species density.

Threatened, Endangered and Sensitive Species

U.S. Fish & Wildlife (USFWS), Bureau of Land Management (BLM) and USDA Forest Service (USFS) lists were consulted prior to initiation of the field studies. No threatened, endangered, rare or otherwise sensitive plants were observed within the study areas during the course of the field sampling and surveys. As described previously in this report, most of the proposed new disturbances in the North Rilda Canyon Portal Facilities were located within areas that have been disturbed previously by historical coal mining activities and later reclaimed by the state's AMR program (i.e. the main facilities area). It is therefore highly unlikely that endangered, threatened or rare species would be present in those areas.

There were, however, areas proposed for disturbance that have not been disturbed by previous mining (i.e. leachfield, riparian and soil borrow areas). In those areas there was a potential of the following plants to be present: canyon sweetvetch (*Hedysarum occidentale* var. *canone*) and Link Trial columbine (*Aquilegia flavescens* var. *rubicunda*). These plants have been listed as "sensitive" in the Manti LaSal National Forest by the USDA Forest Service. These plants, including ideal habitat for these plants, were not found during the plant surveys.

DISCUSSION

For the most part, all Reference Areas chosen to represent their respective proposed disturbed areas should be appropriate standards for future revegetation success. Figures 1 through 5 statistically compares the total living cover of each area proposed for disturbance with its Reference Area. Figures 6 through 10 compares the woody species densities of each of these areas.

As the figures illustrate, for most areas *the statistical tests showed no significant difference for*

cover and woody species densities when the proposed disturbed areas were compared to the reference areas. One exception with the comparison made between the AMR areas. The proposed disturbed Pinyon-Juniper/Mountain Brush area had significantly *less* cover and *greater* woody species density when compared with its Reference Area. As mentioned in the RESULTS section, it was difficult to encounter a Reference Area that was more similar to the area proposed for disturbance, than the one that was chosen. Because exposure was somewhat different, the proposed disturbed area was, to some degree, dryer than the chosen Reference Area. This difference was reflected in the data summaries. After revegetation, and at the time of final bond release, it should be possible to make adjustments based on the data differences found with this study.

One other statistical difference in the proposed disturbed data sets when compared to the Reference Areas was woody species density (and one living cover result) in the Sagebrush/Grass communities. It seems density of the reference area for this community was significantly higher than those of the proposed disturbed communities it was chosen to represent. Actually, the woody species densities were quite high in all of the Sagebrush/Grass communities (proposed disturbed *and* reference areas). Because these density values were so high, it may even be recommended to decrease the standard, or the number of woody plants per acre, so it may favor the establishment of more herbaceous species.

SUMMARY & CONCLUSIONS

All major plant community types that would be affected by disturbances due to proposed new operations in the North Rilda Canyon Portal Facilities area were quantitatively sampled – including those communities that had been disturbed by previous mining and reclamation activities, as well as native undisturbed areas. Moreover, Reference Areas, or those areas that were similar to the proposed disturbed areas with respect to plant community structure, topography, soil, elevation, exposure, slope and other environmental variables were also sampled with the idea to use them in the future as revegetation success standards once the proposed new mining operations are terminated and the areas are reclaimed to their approximate original conditions. All Reference Areas appear to be appropriate revegetation standards as demonstrated by comparing them with data of the proposed disturbed areas by using statistical methods as well as other comparisons of the data sets provided in this report.

Table 2. Cover by Species, Frequency, Total Cover, and Composition.
Rilda Canyon New Facilities Area (No. 1 from Table 1).
Proposed Disturbed Pinyon-Juniper/Mtn. Brush Community.

(Previous Disturbed and AMR Area).			
A. COVER BY SPECIES	**Mean**	**SDev.**	**Freq**
TREES & SHRUBS			
Artemisia dracunculus	0.07	0.36	3.33
Artemisia tridentata	1.43	4.57	10.00
Cercocarpus ledifolius	0.50	2.69	3.33
Chrysothamnus nauseosus	7.27	8.72	53.33
Gutierrezia sarothrae	0.50	1.59	10.00
Rosa woodsii	0.73	2.93	6.67
FORBS			
Aster sp.	0.27	1.03	6.67
Cynoglossum officinale	0.33	1.25	6.67
Lepidium perfoliatum	0.23	0.96	6.67
Medicago sativa	1.20	3.19	16.67
Taraxacum officinale	0.07	0.36	3.33
GRASSES			
Bromus carinatus	7.47	10.73	60.00
Elymus cinereus	3.40	9.09	20.00
Elymus hispidus	1.93	10.41	3.33
Elymus lanceolatus	7.60	9.42	56.67
Elymus salinus	0.67	2.81	6.67
Elymus smithii	8.50	10.89	53.33
Elymus trachycaulus	0.17	0.90	3.33
B. TOTAL COVER			
Total Living Cover	42.33	14.19	
Litter	10.33	4.27	
Bareground	14.50	10.83	
Rock	32.83	17.01	
C. % COMPOSITION			
Shrubs	24.56	22.58	
Forbs	5.42	9.08	
Grasses	70.03	21.52	

Table 3. Cover by Species, Frequency, Total Cover, and Composition. Rilda Canyon New Facilities Area (No. 2 from Table 1).
Reference Area. Pinyon-Juniper/Mtn. Brush Community.

(Previous Disturbed and AMR Area).			
A COVER BY SPECIES	**Mean**	**SDEV.**	**Freq**
TREES & SHRUBS			
Artemisia tridentata	1.50	8.08	3.33
Chrysothamnus nauseosus	0.83	3.18	6.67
FORBS			
Aster foliaceous	0.57	1.73	10.00
Chenopodium sp.	0.17	0.90	3.33
Descurainia pinnata	0.77	2.17	13.33
Lepidium perfoliatum	1.17	4.78	6.67
Medicago sativa	12.77	14.14	73.33
GRASSES			
Agropyron cristatum	1.33	7.18	3.33
Bromus carinatus	4.93	9.08	33.33
Elymus cinereus	3.67	10.24	16.67
Elymus lanceolatus	8.73	13.65	43.33
Elymus smithii	15.90	12.38	76.67
B. TOTAL COVER			
Total Living Cover	52.33	14.19	
Litter	9.70	3.01	
Bareground	10.13	5.71	
Rock	27.83	11.08	
C. % COMPOSITION			
Shrubs	3.35	13.89	
Forbs	31.04	25.74	
Grasses	65.60	26.40	

Table 4. Cover by Species, Frequency, Total Cover, and Composition. Rilda Canyon New Facilities Area (No. 3 from Table 1). Proposed Disturbed Pinyon-Juniper/Mtn. Brush Community.

(Undisturbed).			
A. COVER BY SPECIES	**Mean**	**SDev**	**Freq**
OVERSTORY			
Cercocarpus ledifolius	5.17	12.48	16.67
Juniperus osteosperma	4.83	15.41	10.00
Pinus edulis	3.17	11.44	10.00
Pinus ponderosa	9.83	21.97	20.00
Pseudotsuga menziesii	2.00	10.77	3.33
UNDERSTORY			
TREES & SHRUBS			
Abies concolor	1.33	7.18	3.33
Artemisia tridentata	0.33	1.80	3.33
Cercocarpus ledifolius	2.97	7.36	20.00
Gutierrezia sarothrae	0.33	1.47	6.67
Juniperus osteosperma	3.33	9.69	13.33
Pinus edulis	5.67	11.31	26.67
Pinus ponderosa	2.67	9.01	10.00
Pseudotsuga menziesii	1.33	7.18	3.33
Rhus simplicifolia	1.33	5.62	6.67
Rosa woodsii	0.10	0.54	3.33
FORBS			
Artemisia carruthii	0.17	0.90	3.33
Aster chilensis	0.23	0.96	6.67
GRASSES			
Elymus salinus	8.93	9.28	63.33
Stipa hymenoides	0.60	2.73	6.67
B. TOTAL COVER			
Overstory (o)	25.00	25.66	
Understory (u)	29.33	12.70	
Litter	28.17	19.56	
Bareground	14.63	8.69	
Rock	27.87	16.76	
o+u	54.33	30.98	
C. % COMPOSITION			
Woody Plants	58.64	40.06	
Forbs	1.33	4.99	
Grasses	40.03	39.80	

Table 5. Cover by Species, Frequency, Total Cover, and Composition. Rilda Canyon New Facilities Area (No. 4 from Table 1). Reference Area Pinyon-Juniper/Mtn. Brush Community.

(Undisturbed).			
A. COVER BY SPECIES	**Mean**	**SDev**	**Freq**
OVERSTORY			
Cercocarpus ledifolius	14.27	24.38	30.00
Juniperus osteosperma	4.73	12.34	13.33
Pinus edulis	3.67	11.47	10.00
Pinus ponderosa	2.50	13.46	3.33
UNDERSTORY			
TREES & SHRUBS			
Cercocarpus ledifolius	4.50	9.16	26.67
Eriogonum corymbosum	0.60	2.73	6.67
Euphorbia fendleri	0.17	0.90	3.33
Gutierrezia sarothrae	1.50	4.06	20.00
Juniperus osteosperma	2.60	7.77	13.33
Mahonia repens	0.93	1.73	26.67
Pinus edulis	4.50	11.86	16.67
Rhus simplicifolia	3.83	13.02	10.00
FORBS			
Artemisia dracunculus	0.07	0.36	3.33
Erigeron sp.	0.27	1.03	6.67
Phlox sp.	0.17	0.90	3.33
GRASSES			
Elymus salinus	18.20	15.90	83.33
Poa secunda	0.17	0.90	3.33
Stipa hymenoides	1.17	3.08	13.33
B. TOTAL COVER			
Overstory (o)	25.17	27.67	
Understory (u)	38.67	14.02	
Litter	19.50	19.59	
Bareground	14.10	10.40	
Rock	27.73	16.81	
o+u	63.83	30.54	
C. % COMPOSITION			
Woody Plants	45.48	33.79	
Forbs	1.22	4.67	
Grasses	53.31	33.40	

Table 6. Cover by Species, Frequency, Total Cover, and Composition. Rilda Canyon New Facilities Area (No. 5 from Table 1).
Proposed Disturbed Riparian Community.

(Undisturbed)			
A. COVER BY SPECIES	**Mean**	**SDev**	**Freq**
OVERSTORY			
Acer glabrum	1.00	4.90	4.00
Betula occidentalis	3.00	14.70	4.00
Cornus sericea	4.04	11.16	12.00
Picea pungens	12.60	27.21	20.00
Populus angustifolia	28.76	30.98	52.00
Populus tremuloides	1.20	5.88	4.00
Pseudotsuga menziesii	4.00	15.30	8.00
Rosa woodsii	1.00	4.90	4.00
Salix lutea	1.40	6.86	4.00
UNDERSTORY			
TREES & SHRUBS			
Acer glabrum	1.20	4.96	8.00
Betula occidentalis	1.20	5.88	4.00
Cornus sericea	12.40	23.07	28.00
Mahonia repens	1.60	7.84	4.00
Picea pungens	1.12	3.96	8.00
Populus angustifolia	2.80	8.38	12.00
Populus tremuloides	0.20	0.98	4.00
Pseudotsuga menziesii	1.80	7.05	8.00
Ribes aureum	2.92	9.28	16.00
Rosa woodsii	3.80	12.83	20.00
Symphoricarpos oreophilus	0.20	0.98	4.00
FORBS			
Circium sp.	0.16	0.78	4.00
Equisetum arvensis	1.40	4.80	8.00
Galium boreale	1.40	4.80	8.00
Geranium richardsonii	2.80	8.13	20.00
Osmorhiza depauperata	0.40	1.96	4.00
Smilacina stellata	0.60	2.94	4.00
Stellaria jamesii	0.20	0.98	4.00
Verbascum thapsus	0.20	0.98	4.00
GRASSES			
Agrostis stolonifera	7.60	20.65	16.00
Dactylis glomeratus	1.80	7.05	8.00
Elymus trachycaulus	2.60	9.91	12.00
Poa fendleriana	0.60	2.15	8.00
B. TOTAL COVER			
Overstory (o)	57.00	26.68	
Understory (u)	49.00	22.54	
Litter	32.80	19.56	
Bareground	11.84	16.17	
Rock	6.36	12.10	
o+u	106.00	20.64	
C. % COMPOSITION			
Woody Plants	61.33	41.11	
Forbs	18.97	30.34	
Grasses	19.69	31.51	

Table 7. Cover by Species, Frequency, Total Cover, and Composition. Rilda Canyon New Facilities Area (No. 6 from Table 1). Reference Area Riparian Community.

(Undisturbed).			
A. COVER BY SPECIES	**Mean**	**SDev**	**Freq**
OVERSTORY			
Abies concolor	0.75	3.27	5.00
Cornus sericea	1.25	5.45	5.00
Picea pungens	26.50	35.71	40.00
Populus angustifolia	22.50	31.28	40.00
Populus tremuloides	4.25	13.90	10.00
Prunus virginiana	0.75	3.27	5.00
UNDERSTORY			
SHRUBS			
Abies concolor	1.50	4.77	10.00
Acer glabrum	2.35	4.94	25.00
Cornus sericea	4.25	15.27	15.00
Mahonia repens	1.80	7.62	10.00
Picea pungens	2.75	8.14	15.00
Populus angustifolia	2.90	6.95	15.00
Populus tremuloides	4.25	9.91	20.00
Rosa woodsii	8.60	17.12	35.00
Symphoricarpos oreophilus	4.35	11.31	15.00
FORBS			
Achillea millefolium	0.25	1.09	5.00
Circium sp.	0.50	1.50	10.00
Cynoglossum officinale	0.75	1.79	15.00
Equisetum arvensis	5.10	10.63	30.00
Galium boreale	0.40	1.74	5.00
Geranium richardsonii	1.25	3.11	15.00
Rubus idaeus	1.00	4.36	5.00
Taraxacum officinale	1.25	5.45	5.00
Tragopogon dubius	0.25	1.09	5.00
GRASSES			
Agrostis stolonifera	1.25	5.45	5.00
Juncus sp.	0.25	1.09	5.00
Poa fendleriana	4.75	11.56	15.00
Poa pratensis	2.25	9.81	5.00
B. TOTAL COVER			
Overstory (o)	56.00	30.97	
Understory (u)	52.00	20.94	
Litter	31.70	21.15	
Bareground	13.20	12.95	
Rock	3.10	2.47	
o+u	108.00	20.70	
C. % COMPOSITION			
Shrubs	64.19	37.07	
Forbs	20.49	26.77	
Grasses	15.32	28.76	

Table 8. Cover by Species, Frequency, Total Cover, and Composition.
Rilda Canyon Leachfield Area (No. 7 from Table 1).
Proposed Disturbed. Sagebrush/Grass Community.

(Undisturbed)			
A. COVER BY SPECIES	**Mean**	**SDev**	**Freq**
OVERSTORY			
Rhus simplicifolia	0.83	4.49	3.33
UNDERSTORY			
TREES & SHRUBS			
Artemisia tridentata	13.17	12.55	83.33
Chrysothamnus nauseosus	2.33	7.72	13.33
Gutierrezia sarothrae	1.33	2.12	30.00
Opuntia polyacantha	0.17	0.90	3.33
Rhus simplicifolia	0.17	0.90	3.33
Rosa woodsii	0.23	1.26	3.33
FORBS			
Antennaria neglecta	2.40	6.68	23.33
Artemisia dracunculus	0.23	0.96	6.67
Aster sp.	0.10	0.54	3.33
Circium sp.	0.17	0.90	3.33
Erigeron sp.	1.23	2.11	26.67
Lepidium perfoliatum	0.77	2.17	13.33
Taraxacum officinale	0.77	2.17	13.33
Tragopogon dubius	0.33	1.25	6.67
GRASSES			
Bouteloua gracilis	0.67	2.49	6.67
Bromus tectorum	2.33	8.34	13.33
Elymus salinus	4.77	9.79	30.00
Poa secunda	7.17	8.73	53.33
Stipa comata	18.67	14.08	90.00
B. TOTAL COVER			
Overstory (o)	0.83	4.49	
Understory (u)	57.00	10.69	
Litter	19.37	10.42	
Bareground	18.53	14.15	
Rock	5.10	4.61	
o+u	57.83	11.08	
C. % COMPOSITION			
Woody Plants	29.09	21.22	
Forbs	10.05	13.89	
Grasses	60.86	21.26	

Table 9. Cover by Species, Frequency, Total Cover, and Composition. Rilda Canyon Leachfield Area (No. 8 from Table 1). Reference Area Sagebrush/Grass Community.

(Undisturbed).			
A. COVER BY SPECIES	**Mean**	**SDev**	**Freq**
TREES & SHRUBS			
Artemisia tridentata	14.37	13.65	70.00
Chrysothamnus nauseosus	6.07	8.79	43.33
Juniperus osterosperma	0.50	2.69	3.33
Opuntia polyacantha	0.17	0.90	3.33
Rosa woodsii	1.07	2.83	13.33
Symphoricarpos oreophilus	1.17	4.60	10.00
FORBS			
Artemisia dracunculus	0.50	2.69	3.33
Circium sp.	0.17	0.90	3.33
Cynoglossum officinale	1.57	3.44	23.33
Erigeron sp.	0.33	1.80	3.33
Lepidium perfoliatum	0.67	1.70	13.33
Machaeranthera canescens	0.33	1.25	6.67
Taraxicum officinale	3.27	6.36	30.00
GRASSES			
Elymus salinus	4.17	10.25	16.67
Elymus trachycaulus	0.33	1.80	3.33
Elymus trachycaulus	0.17	0.90	3.33
Poa fendleriana	1.83	6.39	10.00
Poa secunda	13.50	13.85	60.00
Stipa comata	7.33	12.76	33.33
B. TOTAL COVER			
Total Living Cover	57.50	11.88	
Litter	30.33	10.95	
Bareground	7.73	8.21	
Rock	4.43	5.74	
C. % COMPOSITION			
Shrubs	39.29	20.54	
Forbs	12.88	16.00	
Grasses	47.83	17.22	

Table 10. Cover by Species, Frequency, Total Cover, and Composition.
Rilda Canyon Upper Borrow Area (No. 9 from Table 1).
Proposed Disturbed. Sagebrush/Grass (Scattered P-J) Community.

(Undisturbed)			
A. COVER BY SPECIES	**Mean**	**SDev**	**Freq**
TREES & SHRUBS			
Artemisia tridentata	15.12	18.38	72.00
Cercocarpus ledifolius	0.80	3.92	4.00
Chrysothamnus nauseosus	0.60	2.15	8.00
Gutierrezia sarothrae	2.08	3.60	28.00
Juniperus scopulorum	0.40	1.96	4.00
Pinus pondersosa	0.40	1.36	8.00
FORBS			
Antennaria neglecta	0.60	2.15	8.00
Artemisia dracunculus	0.96	1.84	24.00
Circium sp.	0.40	1.17	12.00
Erigeron sp.	0.12	0.59	4.00
Eriogonum sp.	0.40	1.36	8.00
Lappula occidentalis	0.40	1.96	4.00
Lepidium perfoliatum	0.20	0.98	4.00
Machaeranthera canescens	0.52	1.45	12.00
GRASSES			
Bouteloua gracilis	6.40	13.38	24.00
Bromus tectorum	0.20	0.98	4.00
Elymus lanceolatus	0.40	1.96	4.00
Elymus salinus	3.20	6.14	28.00
Elymus trachycaulus	0.40	1.96	4.00
Poa secunda	4.00	6.16	40.00
Stipa comata	12.80	17.33	60.00
B. TOTAL COVER			
Cryptogams	1.00	2.83	
Understory	50.40	16.43	
Litter	17.76	9.96	
Bareground	25.68	19.47	
Rock	5.16	8.88	
C. % COMPOSITION			
Woody Plants	36.23	23.46	
Forbs	9.85	14.54	
Grasses	53.91	25.03	

Table 11. Cover by Species, Frequency, Total Cover, and Composition. Rilda Canyon Lower Borrow Area (No. 10 from Table 1). Proposed Disturbed Pinyon-Juniper/Mtn. Brush Community.

(Undisturbed).			
A. COVER BY SPECIES	**Mean**	**SDev**	**Freq**
OVERSTORY			
Cercocarpus ledifolius	7.00	16.08	20.00
Juniperus osterosperma	2.50	10.90	5.00
Juniperus scopulorum	3.00	11.00	10.00
Pinus edulis	11.50	27.39	15.00
Rhus simplicifolia	0.50	2.18	5.00
UNDERSTORY			
TREES & SHRUBS			
Amalanchier utahensis	0.50	2.18	5.00
Artemisia tridentata	2.50	7.66	10.00
Ceratoides lanata	0.75	3.27	5.00
Cercocarpus ledifolius	3.25	8.41	15.00
Chrysothamnus nauseosus	0.25	1.09	5.00
Gutierrezia sarothrae	0.25	1.09	5.00
Juniperus osterosperma	1.00	4.36	5.00
Juniperus scopulorum	2.25	8.73	10.00
Lepidium montanum	0.75	3.27	5.00
Pinus edulis	2.15	5.86	15.00
Pinus pondersosa	0.40	1.74	5.00
Rhus simplicifolia	1.25	3.83	10.00
Rosa woodsii	1.00	3.00	10.00
Yucca harrmaniae	0.50	1.50	10.00
FORBS			
Aster sp.	0.25	1.09	5.00
Circium sp.	0.10	0.44	5.00
Erigeron sp.	0.25	1.09	5.00
Euphorbia fendleri	0.10	0.44	5.00
GRASSES			
Bromus carinatus	0.25	1.09	5.00
Elymus salinus	5.40	7.90	50.00
Stipa comata	1.25	5.45	5.00
Stipa hymenoides	2.60	4.84	30.00
B. TOTAL COVER			
Overstory	24.50	34.92	
Crytogams	1.50	4.50	
Understory	27.00	18.60	
Litter	27.55	25.01	
Bareground	23.00	23.37	
Rock	20.95	21.16	
Overstory + Understory	51.50	32.64	
C. % COMPOSITION			
Woody Plants	54.95	40.62	
Forbs	3.21	6.53	
Grasses	41.83	40.90	

Table 12. Cover by Species, Frequency, Total Cover, and Composition.
Rilda Canyon Lower Borrow Area (No. 11 from Table 1).
Proposed Disturbed. Sagebrush/Grass. Brush Community.

(Undisturbed)			
A. COVER BY SPECIES	**Mean**	**SDev**	**Freq**
TREES & SHRUBS			
Artemisia tridentata	15.10	14.34	80.00
Chrysothamnus nauseosus	4.40	11.31	25.00
Chrysothamnus viscidiflorus	0.25	1.09	5.00
Gutierrezia sarothrae	0.50	1.50	10.00
Pinus edulis	3.00	8.28	15.00
Symphoricarpos oreophilus	1.00	4.36	5.00
Yucca harmaniae	0.50	2.18	5.00
FORBS			
Descurainia pinnata	0.60	1.53	15.00
Erigeron sp.	0.25	1.09	5.00
GRASSES			
Elymus salinus	6.15	15.22	40.00
Poa secunda	0.75	2.38	10.00
Stipa comata	11.75	12.17	65.00
Stipa hymenoides	1.75	5.54	15.00
B. TOTAL COVER			
CRYTO	2.50	7.50	
Understory	46.00	15.05	
Litter	19.65	7.64	
Bareground	25.45	12.85	
Rock	6.40	5.23	
C. % COMPOSITION			
Woody Plants	55.13	24.45	
Forbs	2.03	4.24	
Grasses	42.85	24.26	

SUMMARY TABLES FOR WOODY SPECIES DENSITY

Table 13. Woody Species Density. Rilda Canyon. New Facilities Area (No. 1 from Table 1). Proposed Disturbed Pinyon-Juniper/Mtn. Brush Community.	
(Previous Disturbed and AMR Area).	
	No/Ac
Artemisia tridentata	171.53
Cercocarpus ledifolius	107.21
Chrysothamnus nauseosus	814.77
Gutierrezia sarothrae	85.76
Rosa woodsii	107.21
Total	**1286.47**

Table 14. Woody Species Density. Rilda Canyon New Facilities Area (No. 2 from Table 1). Reference Area (AMR). Pinyon-Juniper/Mtn. Brush Community.	
(Previous Disturbed and AMR Area).	
	No/Ac
Abies concolor	2.97
Artemisia tridentata	13.38
Ceratoides lanata	2.97
Chrysothamnus nauseosus	135.32
Juniperus scopulorum	1.49
Populus angustifolia	1.49
Populus tremuloides	4.46
Pseudotsuga menziesii	1.49
Rosa woodsii	13.38
Sambucus caerulea	1.49
Total	**178.45**

Table 15. Woody Species Density. Rilda Canyon New Facilities Area (No. 3 from Table 1). Proposed Disturbed Pinyon-Juniper/Mtn. Brush Community.	
(Undisturbed).	
	No/Ac
Abies concolor	21.56
Artemisia tridentata	14.38
Cercocarpus ledifolius	201.26
Chrysothamnus nauseosus	7.19
Eriogonum corymbosum	57.50
Gutierrezia sarothrae	50.32
Juniperus osteosperma	143.76
Mahonia repens	7.19
Picea pungens	14.38
Pinus edulis	222.83
Pinus ponderosa	64.69
Pseudotsuga menziesii	28.75
Rhus aromatica	7.19
Symphoricarpos oreophilus	21.56
Total	**862.56**

Table 16. Woody Species Density Rilda Canyon New Facilities Area (No. 4 from Table 1). Reference Area Pinyon-Juniper/Mtn. Brush Community.	
(Undisturbed).	
	No/Ac
Artemisia tridentata	15.76
Cercocarpus ledifolius	228.52
Chrysothamnus nauseosus	23.64
Chrysothamnus viscidiflorus	7.88
Eriogonum corymbosum	39.40
Gutierrezia sarothrae	126.08
Juniperus osteosperma	157.60
Juniperus scopulorum	7.88
Mahonia repens	94.56
Opuntia polyacantha	7.88
Pinus edulis	133.96
Pinus ponderosa	7.88
Pseudotsuga menziesii	7.88
Rhus aromatica	78.80
Symphoricarpos oreophilus	7.88
Total	**945.59**

Table 17. Woody Species Density. Rilda Canyon New Facilities Area (No. 5 from Table 1). Proposed Disturbed Riparian Community.	
(Undisturbed).	
	No/Ac
Abies concolor	18.66
Acer glabrum	55.98
Betula occidentalis	18.66
Cornus sericea	559.80
Juniperus communis	37.32
Juniperus scopulorum	18.66
Mahonia repens	18.66
Pachystima myrsinites	18.66
Picea pungens	149.28
Populus angustifolia	354.54
Populus tremuloides	74.64
Pseudotsuga menziesii	37.32
Ribes aureum	74.64
Rosa woodsii	354.54
Salix lutea	55.98
Symphoricarpos oreophilus	18.66
Total	**1866.00**

Table 18. Woody Species Density. Rilda Canyon New Facilities Area (No. 6 from Table 1). Reference Area Riparian Community	
(Undisturbed).	
	No/Ac
Abies concolor	65.40
Acer glabrum	65.40
Betula occidentalis	32.70
Cornus sericea	228.89
Juniperus scopulorum	130.80
Mahonia repens	65.40
Picea pungens	326.99
Populus angustifolia	719.38
Populus tremuloides	196.20
Rosa woodsii	653.98
Symphoricarpos oreophilus	130.80
Total	**2615.94**

Table 19. Woody Species Density. Rilda Canyon Leachfield Area (No. 7 from Table 1). Proposed Disturbed Sagebrush/Grass. Brush Community.	
(Undisturbed)	
	No/Ac
Artemisia tridentata	2902.23
Chrysothamnus nauseosus	257.98
Gutierrezia sarothrae	483.71
Juniperus scopulorum	32.25
Opuntia polyacantha	32.25
Pinus edulis	0.00
Pinus ponderosa	32.25
Rosa woodsii	64.49
Symphoricarpos oreophilus	64.49
Total	**3869.65**

Table 20. Woody Species Density. Rilda Canyon Leachfield Area (No. 8 from Table 1). Reference Area. Sagebrush/Grass Community.	
(Undisturbed).	
	No/Ac
Artemisia tridentata	2190.83
Chrysothamnus nauseosus	1112.27
Populus tremuloides	101.12
Rosa woodsii	438.17
Symphoricarpos oreophilus	202.23
Total	**4044.61**

Table 21. Woody Species Density. Rilda Canyon Upper Borrow Area (No. 9 from Table 1). Proposed Disturbed Sagebrush/Grass (Scattered Pinyon-Juniper) Community.	
(Undisturbed)	
	No/Ac
Artemisia tridentata	2226.83
Cercocarpus ledifolius	30.93
Chrysothamnus nauseosus	216.50
Gutierrezia sarothrae	402.07
Juniperus osteosperma	30.93
Pinus ponderosa	123.71
Rosa woodsii	61.86
Total	**3092.82**

Table 22. Woody Species Density. Rilda Canyon Lower Borrow Area (No. 10 from Table 1). Proposed Disturbed Pinyon-Juniper/Mtn. Brush Community.	
(Undisturbed).	
	No/Ac
Artemisia nova	14.47
Artemisia tridentata	72.33
Cercocarpus ledifolius	188.05
Cercocarpus montanus	28.93
Chrysothamnus nauseosus	28.93
Gutierrezia sarothrae	159.12
Juniperus osteosperma	101.26
Juniperus scopulorum	28.93
Pinus edulis	318.24
Pinus ponderosa	28.93
Rhus aromatica	28.93
Rosa woodsii	43.40
Symphoricarpos oreophilus	28.93
Yucca harrimaniae	86.79
Total	**1157.22**

Table 23. Woody Species Density. Rilda Canyon Lower Borrow Area (No. 11 from Table 1). Proposed Disturbed Sagebrush/Grass Brush Community.	
(Undisturbed)	
	No/Ac
Artemisia tridentata	1657.30
Chrysothamnus nauseosus	310.74
Chrysothamnus viscidiflorus	69.05
Gutierrezia sarothrae	414.32
Juniperus osteosperma	34.53
Opuntia polyacantha	138.11
Pinus edulis	69.05
Symphoricarpos oreophilus	34.53
Yucca harrimaniae	34.53
Total	**2762.16**

FIG. 1. MAIN FACILITIES AREA.
A statistical comparison (Student's t-tests) of the **total living cover** (percent) between the proposed disturbed sites and their reference areas in the North Rilda Canyon.

	$\bar{x}$	s	n	t	df	SL
PJ/MB (AMR)						
Proposed Disturbed (1):	42.33	14.19	30			
Reference Area (2):	52.33	14.19	30			
t-test				-2.729	58	p<0.01
PJ/MB (undist.)						
Proposed Disturbed (3):	54.33	30.98	30			
Reference Area (4):	63.83	30.54	30			
t-test				-1.196	58	n.s.
Riparian (undist.)						
Proposed Disturbed (5):	106.00	20.64	25			
Reference Area (6):	108.00	20.70	20			
t-test				-0.323	43	n.s.

$\bar{x}$ = mean
s = standard deviation
n = sample size
t = Student's t-value
df = degrees of freedom
SL= Significance Level
n.s. = non-significant
PJ = Pinyon-Juniper
MB = Mountain Brush
undist. = Undisturbed
(1) = numbers in parenthesis correspond to the community numbers shown on Table 1

FIG. 2. LEACHFIELD AREA.
A statistical comparison (Student's t-tests) of the **total living cover** (percent) between the proposed disturbed sites and their reference areas in the North Rilda Canyon.

	$\bar{x}$	s	n	t	df	SL
S/G (undist.)						
Proposed Disturbed (7):	57.83	11.08	30			
Reference Area (8):	57.50	11.88	30			
t-test				0.111	58	n.s.

$\bar{x}$ = mean
s = standard deviation
n = sample size
t = Student's t-value
df = degrees of freedom
SL= Significance Level
S/G = Sagebrush/Grass
undist. = Undisturbed
(1) = numbers in parenthesis correspond to the community numbers shown on Table 1

FIG. 3. UPPER BORROW AREA.
A statistical comparison (Student's t-tests) of the **total living cover** (percent) between the proposed disturbed sites and their reference areas in the North Rilda Canyon.

	$\bar{x}$	s	n	t	df	SL
S/G (undist.)						
Proposed Disturbed (9):	50.40	16.43	25			
Reference Area (8)	57.50	11.88	30			
t-test				-1.856	53	n.s.

$\bar{x}$ = mean
s = standard deviation
n = sample size
t = Student's t-value
df = degrees of freedom
SL= Significance Level
S/G = Sagebrush/Grass
undist. = Undisturbed
(1) = numbers in parenthesis correspond to the community numbers shown on Table 1

FIG. 4. LOWER BORROW AREA.
A statistical comparison (Student's t-tests) of the **total living cover** (percent) between the proposed disturbed sites and their reference areas in the North Rilda Canyon.

	$\bar{x}$	s	n	t	df	SL
PJ/MB (undist.)						
Proposed Disturbed (10):	51.50	32.64	20			
Reference Area (4)	63.83	30.54	30			
t-test				-1.361	48	n.s.

$\bar{x}$ = mean
s = standard deviation
n = sample size
t = Student's t-value
df = degrees of freedom
SL= Significance Level
PJ = Pinyon-Juniper
MB = Mountain Brush
undist. = Undisturbed
(1) = numbers in parenthesis correspond to the community numbers shown on Table 1

FIG. 5. LOWER BORROW AREA.
A statistical comparison (Student's t-tests) of the **total living cover** (percent) between the proposed disturbed sites and their reference areas in the North Rilda Canyon.

	$\bar{x}$	s	n	t	df	SL
S/G (undist.)						
Proposed Disturbed (11):	46.00	15.05	20			
Reference Area (8)	57.50	11.88	30			
t-test				-3.012	48	p<0.005

$\bar{x}$ = mean
s = standard deviation
n = sample size
t = Student's t-value
df = degrees of freedom
SL= Significance Level
S/G = Sagebrush/Grass
undist. = Undisturbed
(1) = numbers in parenthesis correspond to the community numbers shown on Table 1

FIG. 6. MAIN FACILITIES AREA.
A statistical comparison (Student's t-tests) of the **woody species density** (number/acre) between the proposed disturbed sites and their reference areas in the North Rilda Canyon.

	$\bar{x}$	s	n	t	df	SL
PJ/MB (AMR)						
Proposed Disturbed (1):	1286.47	986.16	30			
Reference Area (2)	178.45	143.47	30			
t-test				6.090	58	p<0.001
PJ/MB (undist.)						
Proposed Disturbed (3):	862.56	389.35	30			
Reference Area (4):	945.59	759.42	30			
t-test				-0.533	58	n.s.
Riparian (undist.)						
Proposed Disturbed (5):	1866.00	1238.99	25			
Reference Area (6):	2615.94	1882.45	20			
t-test				-1.606	43	n.s.

$\bar{x}$ = mean
s = standard deviation
n = sample size
t = Student's t-value
df = degrees of freedom
SL= Significance Level
PJ = Pinyon-Juniper
MB = Mountain Brush
undist. = Undisturbed
(1) = numbers in parenthesis correspond to the community numbers shown on Table 1

FIG. 7. LEACHFIELD AREA.
A statistical comparison (Student's t-tests) of the **woody species density** (number/acre) between the proposed disturbed sites and their reference areas in the North Rilda Canyon.

	$\bar{x}$	s	n	t	df	SL
S/G (undist.)						
Proposed Disturbed (7):	3869.65	2019.65	30			
Reference Area (8)	4044.61	1400.60	30			
t-test				-0.390	58	n.s.

$\bar{x}$ = mean
s = standard deviation
n = sample size
t = Student's t-value
df = degrees of freedom
SL= Significance Level
S/G = Sagebrush/Grass
undist. = Undisturbed
(1) = numbers in parenthesis correspond to the community numbers shown on Table 1

FIG. 8. UPPER BORROW AREA.
A statistical comparison (Student's t-tests) of the **woody species density** (number/acre) between the proposed disturbed sites and their reference areas in the North Rilda Canyon.

	$\bar{x}$	s	n	t	df	SL
S/G (undist.)						
Proposed Disturbed (9):	3092.82	1608.22	25			
Reference Area (8)	4044.61	1400.60	30			
t-test				-2.346	53	$p<0.025$

$\bar{x}$ = mean
s = standard deviation
n = sample size
t = Student's t-value
df = degrees of freedom
SL= Significance Level
S/G = Sagebrush/Grass
undist. = Undisturbed
(1) = numbers in parenthesis correspond to the community numbers shown on Table 1

FIG. 9. LOWER BORROW AREA.
A statistical comparison (Student's t-tests) of the **woody species density** (number per acre) between the proposed disturbed sites and their reference areas in the North Rilda Canyon.

	$\bar{x}$	s	n	t	df	SL
PJ/MB (undist.)						
Proposed Disturbed (10):	1157.22	960.83	20			
Reference Area (4)	945.59	759.42	30			
t-test				0.868	48	n.s.

$\bar{x}$ = mean
s = standard deviation
n = sample size
t = Student's t-value
df = degrees of freedom
SL= Significance Level
PJ = Pinyon-Juniper
MB = Mountain Brush
undist. = Undisturbed
(1) = numbers in parenthesis correspond to the community numbers shown on Table 1

FIG. 10. LOWER BORROW AREA.
A statistical comparison (Student's t-tests) of the **woody species density** (number per acre) between the proposed disturbed sites and their reference areas in the North Rilda Canyon.

	$\bar{x}$	s	n	t	df	SL
S/G (undist.)						
Proposed Disturbed (11):	2762.16	1703.08	20			
Reference Area (8)	4044.61	1400.60	30			
t-test				-2.908	48	p<0.010

$\bar{x}$ = mean
s = standard deviation
n = sample size
t = Student's t-value
df = degrees of freedom
SL= Significance Level
S/G = Sagebrush/Grass
undist. = Undisturbed
(1) = numbers in parenthesis correspond to the community numbers shown on Table 1

COLOR PHOTOGRAPHS OF THE SAMPLE AREAS

Main Facilities Area. Proposed Disturbed Pinyon-Juniper/Mtn. Brush (AMR) - Central

Main Facilities Area. Proposed Disturbed Pinyon-Juniper/Mtn. Brush (AMR) - East

Main Facilities Area. Proposed Disturbed Pinyon-Juniper/Mtn. Brush (AMR) -Old Portal Road

Main Facilities Area. Reference Area. Pinyon-Juniper/Mtn. Brush (AMR)

Main Facilities Area. Proposed Disturbed. Pinyon-Juniper/Mtn. Brush (undisturbed) - East

Main Facilities Area. Proposed Disturbed. Pinyon-Juniper/Mtn. Brush (undisturbed) - West

Main Facilities Area. Reference Area. Pinyon-Juniper/Mtn. Brush (undisturbed) - close view

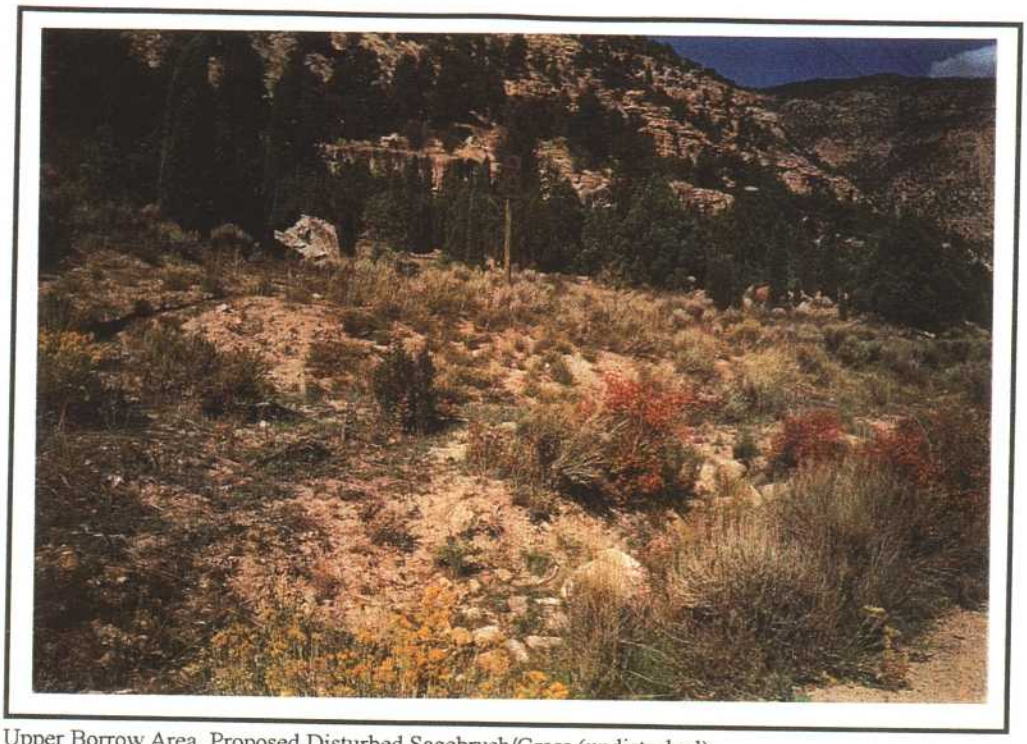
Main Facilities Area. Reference Area. Pinyon-Juniper/Mtn. Brush (undisturbed) - distant view

Main Facilities Area. Proposed Disturbed Riparian (undisturbed)

Main Facilities Area. Reference Area. Riparian (undisturbed)

Leachfield Area. Proposed Disturbed Sagebrush/Grass (undisturbed)

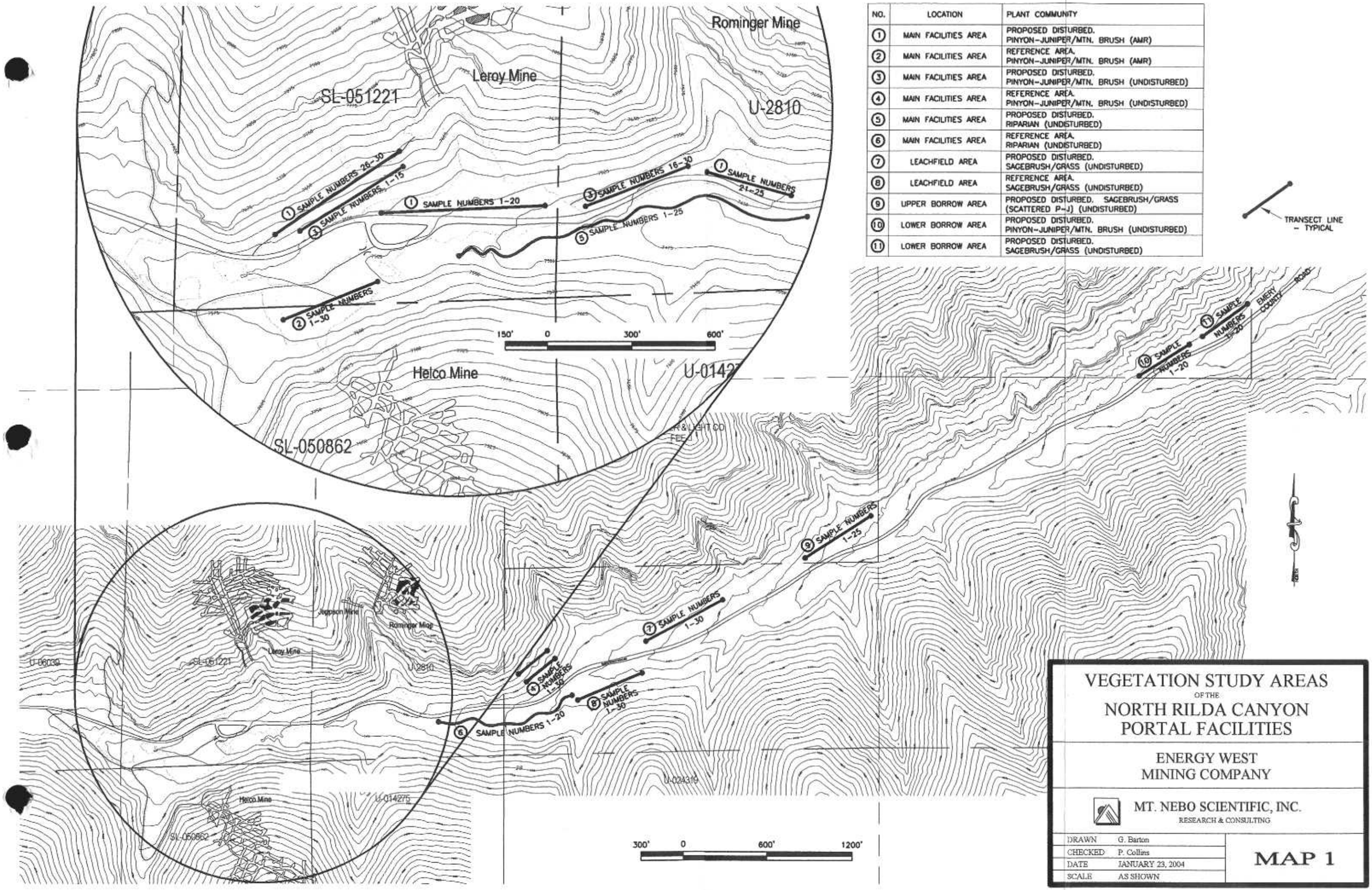
Leachfield Area. Reference Area. Sagebrush/Grass (undisturbed)



Upper Borrow Area. Proposed Disturbed Sagebrush/Grass (undisturbed)

Lower Borrow Area. Proposed Disturbed Pinyon-Juniper/Mtn. Brush (undisturbed)

NO.	LOCATION	PLANT COMMUNITY
1	MAIN FACILITIES AREA	PROPOSED DISTURBED. PINYON-JUNIPER/MTN. BRUSH (AMR)
2	MAIN FACILITIES AREA	REFERENCE AREA. PINYON-JUNIPER/MTN. BRUSH (AMR)
3	MAIN FACILITIES AREA	PROPOSED DISTURBED. PINYON-JUNIPER/MTN. BRUSH (UNDISTURBED)
4	MAIN FACILITIES AREA	REFERENCE AREA. PINYON-JUNIPER/MTN. BRUSH (UNDISTURBED)
5	MAIN FACILITIES AREA	PROPOSED DISTURBED. RIPARIAN (UNDISTURBED)
6	MAIN FACILITIES AREA	REFERENCE AREA. RIPARIAN (UNDISTURBED)
7	LEACHFIELD AREA	PROPOSED DISTURBED. SAGEBRUSH/GRASS (UNDISTURBED)
8	LEACHFIELD AREA	REFERENCE AREA. SAGEBRUSH/GRASS (UNDISTURBED)
9	UPPER BORROW AREA	PROPOSED DISTURBED. SAGEBRUSH/GRASS (SCATTERED P-J) (UNDISTURBED)
10	LOWER BORROW AREA	PROPOSED DISTURBED. PINYON-JUNIPER/MTN. BRUSH (UNDISTURBED)
11	LOWER BORROW AREA	PROPOSED DISTURBED. SAGEBRUSH/GRASS (UNDISTURBED)



VEGETATION STUDY AREAS OF THE NORTH RILDA CANYON PORTAL FACILITIES

ENERGY WEST MINING COMPANY

MT. NEBO SCIENTIFIC, INC.
RESEARCH & CONSULTING

DRAWN	G. Barton
CHECKED	P. Collins
DATE	JANUARY 23, 2004
SCALE	AS SHOWN

MAP 1

R645-301-300 BIOLOGY SECTION

APPENDIX B
VEGETATION PRODUCTIVITY

- **VEGETATION PRODUCTIVITY ESTIMATES LETTER, 10/26/04, NATURAL RESOURCES CONSERVATION SERVICE**

United States Department of Agriculture

NRCS
Natural Resources Conservation Service
350 N. 400 E.
Price, UT 84501
(435) 637-0041
FAX (435) 637-3146

October 26, 2004

Mr. Dennis Oakley
Sr. Environmental Engineer
Energy West Mining Co.
P.O. Box 310
Huntington, UT 84528

Re: Vegetation Productivity Estimates in the Area for Proposed Surface Mining Facilities in Rilda Canyon.

Mr. Oakley,

The Salina Wildrye/Pinyon-Juniper/Curl-Leaf Mt. Mahogany/Ponderosa Pine reference areas produce 700-800 pounds of air dry herbage acre^{-1} year^{-1}. The condition for the sites are high-fair (mid seral) with the potential for these sites slightly lower than the Potential Natural Community (PNC) for this ecological site.

The Sagebrush/Grass/Pinyon-Juniper reference areas produce 750-800 pounds of air dry herbage acre^{-1} year^{-1}. The condition for the sites are low-fair (mid seral) with the potential for these sites slightly lower than the PNC for this ecological site.

Observations of the Aspen/Fir reference areas indicate that production estimates conducted by George S. Cook on September 21, 1994 are representative of current production estimates. Please refer to this document for these production estimates.

If you have any questions or comments please feel free to contact me at any time.

Sincerely,

M. Dean Stacy
Range Conservationist

cc: Jim Brown, Area Range Conservationist
Tim Julander, Acting District Conservationist
file

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R645-301-300 BIOLOGY SECTION

APPENDIX C
THREATENED AND ENDANGERED SPECIES

♦ **County Lists of Utah's Federally Listed Threatened, Endangered and Candidate Species, 5/21/04, Utah Division of Wildlife Resources**

County Lists of Utah's Federally Listed Threatened(T), Endangered(E), and Candidate(C) Species

Beaver County

Common Name	Scientific Name	Status
California Condor - Historically	*Gymnogypes californianus*	E Experimental
Bald Eagle	*Haliaeetus leucocephalus*	T
Yellow-billed Cuckoo - Possibly	*Coccyzus americanus*	C
Utah Prairie-dog	*Cynomys parvidens*	T

Box Elder County

Common Name	Scientific Name	Status
Fat-whorled Pondsnail	*Stagnicola bonnevillensis*	C
Lahontan Cutthroat Trout - Introduced	*Oncorhynchus clarki henshawii*	T
June Sucker - Introduced	*Chasmistes liorus*	E
Bald Eagle	*Haliaeetus leucocephalus*	T
Yellow-billed Cuckoo - Possibly	*Coccyzus americanus*	C
Gray Wolf - Historically	*Canis lupus*	T Extirpated

Cache County

Common Name	Scientific Name	Status
Maguire Primrose	*Primula maguirei*	T
Bald Eagle	*Haliaeetus leucocephalus*	T
Yellow-billed Cuckoo - Possibly	*Coccyzus americanus*	C
Brown (Grizzly) Bear - Historically	*Ursus arctos*	T Extirpated
Canada Lynx - Possibly	Lynx canadensis	T

Carbon County

Common Name	Scientific Name	Status
Uinta Basin Hookless Cactus	*Sclerocactus glaucus*	T
Graham Beardtongue	*Penstemon grahamii*	C
Humpback Chub	*Gila cypha*	E
Bonytail	*Gila elegans*	E
Colorado Pikeminnow	*Ptychocheilus lucius*	E
Razorback Sucker	*Xyrauchen texanus*	E
Bald Eagle	*Haliaeetus leucocephalus*	T
Yellow-billed Cuckoo - Possibly	*Coccyzus americanus*	C
Mexican Spotted Owl - Possibly	*Strix occidentalis lucida*	T
Black-footed Ferret - Unconfirmed	*Mustela nigripes*	E Extirpated

Daggett County

Common Name	Scientific Name	Status
Ute Ladies'-tresses	*Spiranthes diluvialis*	T
Humpback Chub - Historically	*Gila cypha*	E
Bonytail - Historically	*Gila elegans*	E
Colorado Pikeminnow	*Ptychocheilus lucius*	E
Razorback Sucker - Historically	*Xyrauchen texanus*	E
Bald Eagle - Breeding	*Haliaeetus leucocephalus*	T
Yellow-billed Cuckoo - Possibly	*Coccyzus americanus*	C
Black-footed Ferret - Unconfirmed	*Mustela nigripes*	E Extirpated
Brown (Grizzly) Bear - Historically	*Ursus arctos*	T Extirpated
Canada Lynx	*Lynx canadensis*	T

Davis County

Common Name	Scientific Name	Status
Bald Eagle - Breeding	*Haliaeetus leucocephalus*	T
Yellow-billed Cuckoo	*Coccyzus americanus*	C

Duchesne County

Common Name	Scientific Name	Status
Ute Ladies'-tresses	*Spiranthes diluvialis*	T
Shrubby Reed-mustard	*Glaucocarpum suffrutescens*	E
Barneby Ridge-cress	*Lepidium barnebyanum*	E
Uinta Basin Hookless Cactus	*Sclerocactus glaucus*	T
Graham Beardtongue	*Penstemon grahamii*	C
Humpback Chub - Possibly	*Gila cypha*	E
Bonytail - Possibly	*Gila elegans*	E
Colorado Pikeminnow - Possibly	*Ptychocheilus lucius*	E
Razorback Sucker - Possibly	*Xyrauchen texanus*	E
Bald Eagle	*Haliaeetus leucocephalus*	T
Yellow-billed Cuckoo	*Coccyzus americanus*	C
Black-footed Ferret - Unconfirmed	*Mustela nigripes*	E Experimental
Gray Wolf - Historically	*Canis lupus*	T Extirpated
Brown (Grizzly) Bear - Historically?	*Ursus arctos*	T Extirpated
Canada Lynx	*Lynx canadensis*	T

Emery County

Common Name	Scientific Name	Status
Jones Cycladenia	*Cycladenia humilis var jonesii*	T
Maguire Daisy	*Erigeron maguirei*	T
Last Chance Townsendia	*Townsendia aprica*	T
Barneby Reed-mustard	*Schoenocrambe barnebyi*	E
San Rafael Cactus	*Pediocactus despainii*	E
Winkler Pincushion Cactus	*Pediocactus winkleri*	T
Wright Fishhook Cactus	*Sclerocactus wrightiae*	E
Humpback Chub	*Gila cypha*	E
Bonytail	*Gila elegans*	E
Colorado Pikeminnow	*Ptychocheilus lucius*	E
Razorback Sucker	*Xyrauchen texanus*	E
Bald Eagle - Breeding	*Haliaeetus leucocephalus*	T
Yellow-billed Cuckoo - Possibly	*Coccyzus americanus*	C
Mexican Spotted Owl	*Strix occidentalis lucida*	T
Southwestern Willow Flycatcher	*Empidonax traillii extimus*	E
Black-footed Ferret - Unconfirmed	*Mustela nigripes*	E Extirpated

Garfield County

Common Name	Scientific Name	Status
Maguire Daisy	*Erigeron maguirei*	T
Ute Ladies'-tresses	*Spiranthes diluvialis*	T
Jones Cycladenia	*Cycladenia humilis var jonesii*	T
Autumn Buttercup	*Ranunculus aestivalis*	E
Aquarius Indian Paintbrush	*Castilleja aquariensis*	C
Humpback Chub	*Gila cypha*	E
Bonytail	*Gila elegans*	E
Colorado Pikeminnow	*Ptychocheilus lucius*	E
Razorback Sucker	*Xyrauchen texanus*	E
California Condor - Possibly	*Gymnogypes californianus*	E Experimental
Bald Eagle	*Haliaeetus leucocephalus*	T
Yellow-billed Cuckoo	*Coccyzus americanus*	C
Mexican Spotted Owl	*Strix occidentalis lucida*	T
Southwestern Willow Flycatcher	*Empidonax traillii extimus*	E
Utah Prairie-dog	*Cynomys parvidens*	T
Brown (Grizzly) Bear - Historically?	*Ursus arctos*	T Extirpated

Grand County

Common Name	Scientific Name	Status
Jones Cycladenia	*Cycladenia humilis var jonesii*	T
Humpback Chub	*Gila cypha*	E
Bonytail	*Gila elegans*	E
Colorado Pikeminnow	*Ptychocheilus lucius*	E
Razorback Sucker	*Xyrauchen texanus*	E
California Condor	*Gymnogypes californianus*	E Experimental
Bald Eagle - Breeding	*Haliaeetus leucocephalus*	T
Gunnison Sage-grouse	*Centrocercus minimus*	C
Yellow-billed Cuckoo	*Coccyzus americanus*	C
Mexican Spotted Owl - Possibly	*Strix occidentalis lucida*	T
Southwestern Willow Flycatcher	*Empidonax traillii extimus*	E
Black-footed Ferret - Unconfirmed	*Mustela nigripes*	E Extirpated

Iron County

Common Name	Scientific Name	Status
California Condor - Historically	*Gymnogypes californianus*	E Experimental
Bald Eagle	*Haliaeetus leucocephalus*	T
Yellow-billed Cuckoo	*Coccyzus americanus*	C
Mexican Spotted Owl	*Strix occidentalis lucida*	T
Southwestern Willow Flycatcher	*Empidonax traillii extimus*	E
Utah Prairie-dog	*Cynomys parvidens*	T

Juab County

Common Name	Scientific Name	Status
Ute Ladies'-tresses - Possibly	*Spiranthes diluvialis*	T
Bald Eagle	*Haliaeetus leucocephalus*	T
Yellow-billed Cuckoo	*Coccyzus americanus*	C

Kane County

Common Name	Scientific Name	Status
Welsh's Milkweed	*Asclepias welshii*	T
Kodachrome Bladderpod	*Lesquerella tumulosa*	E
Siler Pincushion Cactus	*Pediocactus sileri*	T
Jones Cycladenia	*Cycladenia humilis var jonesii*	T
Navajo Sedge	*Carex specuicola*	T
Kanab Ambersnail	*Oxyloma kanabense*	E
Coral Pink Sand Dunes Tiger Beetle	*Cicindela limbata albissima*	C
Humpback Chub - Historically	*Gila cypha*	E
Bonytail - Historically	*Gila elegans*	E
Colorado Pikeminnow - Historically	*Ptychocheilus lucius*	E
Razorback Sucker - Historically	*Xyrauchen texanus*	E
California Condor	*Gymnogypes californianus*	E Experimental
Bald Eagle	*Haliaeetus leucocephalus*	T
Yellow-billed Cuckoo - Possibly	*Coccyzus americanus*	C
Mexican Spotted Owl	*Strix occidentalis lucida*	T
Southwestern Willow Flycatcher	*Empidonax traillii extimus*	E
Utah Prairie-dog	*Cynomys parvidens*	T

Millard County

Common Name	Scientific Name	Status
Bald Eagle	*Haliaeetus leucocephalus*	T
Yellow-billed Cuckoo - Possibly	*Coccyzus americanus*	C
Utah Prairie-dog	*Cynomys parvidens*	T

Morgan County

Common Name	Scientific Name	Status
Bald Eagle	*Haliaeetus leucocephalus*	T
Yellow-billed Cuckoo - Possibly	*Coccyzus americanus*	C
Canada Lynx - Possibly	*Lynx canadensis*	T

Piute County

Common Name	Scientific Name	Status
Bald Eagle	*Haliaeetus leucocephalus*	T
Yellow-billed Cuckoo - Possibly	*Coccyzus americanus*	C
Utah Prairie-dog	*Cynomys parvidens*	T

Rich County

Common Name	Scientific Name	Status
Bald Eagle	*Haliaeetus leucocephalus*	T
Black-footed Ferret - Unconfirmed	*Mustela nigripes*	E Extirpated
Canada Lynx - Possibly	*Lynx canadensis*	T

Salt Lake County

Common Name	Scientific Name	Status
Ute Ladies'-tresses - Historically	*Spiranthes diluvialis*	T
Slender Moonwort	*Botrychium lineare*	C
June Sucker - Introduced	*Chasmistes liorus*	E
Bald Eagle	*Haliaeetus leucocephalus*	T
Yellow-billed Cuckoo	*Coccyzus americanus*	C
Canada Lynx - Possibly	*Lynx canadensis*	T

San Juan County

Common Name	Scientific Name	Status
Navajo Sedge	*Carex specuicola*	T
Humpback Chub	*Gila cypha*	E
Bonytail	*Gila elegans*	E
Colorado Pikeminnow	*Ptychocheilus lucius*	E
Razorback Sucker	*Xyrauchen texanus*	E
California Condor - Possibly	*Gymnogypes californianus*	E Experimental
Bald Eagle	*Haliaeetus leucocephalus*	T
Gunnison Sage-grouse	*Centrocercus minimus*	C
Yellow-billed Cuckoo - Possibly	*Coccyzus americanus*	C
Mexican Spotted Owl	*Strix occidentalis lucida*	T
Southwestern Willow Flycatcher	*Empidonax traillii extimus*	E
Black-footed Ferret - Historically	*Mustela nigripes*	E Extirpated
Gray Wolf - Historically	*Canis lupus*	E Extirpated
Brown (Grizzly) Bear - Historically?	*Ursus arctos*	T Extirpated

Sanpete County

Common Name	Scientific Name	Status
Heliotrope Milkvetch	*Astragalus montii*	T
Bald Eagle	*Haliaeetus leucocephalus*	T
Yellow-billed Cuckoo - Possibly	*Coccyzus americanus*	C
Utah Prairie-dog	*Cynomys parvidens*	T
Brown (Grizzly) Bear - Historically	*Ursus arctos*	T Extirpated
Canada Lynx - Historically	*Lynx canadensis*	T

Sevier County

Common Name	Scientific Name	Status
Last Chance Townsendia	*Townsendia aprica*	T
Wright Fishhook Cactus	*Sclerocactus wrightiae*	E
Heliotrope Milkvetch	*Astragalus montii*	T
Bald Eagle	*Haliaeetus leucocephalus*	T
Yellow-billed Cuckoo - Possibly	*Coccyzus americanus*	C
Utah Prairie-dog	*Cynomys parvidens*	T
Brown (Grizzly) Bear - Historically	*Ursus arctos*	T Extirpated

Summit County

Common Name	Scientific Name	Status
Bald Eagle	*Haliaeetus leucocephalus*	T
Yellow-billed Cuckoo - Possibly	*Coccyzus americanus*	C
Black-footed Ferret - Unconfirmed	*Mustela nigripes*	E Extirpated
Brown (Grizzly) Bear - Historically?	*Ursus arctos*	T Extirpated
Canada Lynx	*Lynx canadensis*	T

Tooele County

Common Name	Scientific Name	Status
Ute Ladies'-tresses	*Spiranthes diluvialis*	T
Yellow-billed Cuckoo - Possibly	*Coccyzus americanus*	C
Bald Eagle	*Haliaeetus leucocephalus*	T

Uintah County

Common Name	Scientific Name	Status
Ute Ladies'-tresses	*Spiranthes diluvialis*	T
Shrubby Reed-mustard	*Glaucocarpum suffrutescens*	E
Clay Reed-mustard	*Schoenocrambe argillacea*	T
Uinta Basin Hookless Cactus	*Sclerocactus glaucus*	T
Horseshoe Milkvetch	*Astragalus equisolensis*	C
Graham Beardtongue	*Penstemon grahamii*	C
White River Beardtongue	*Penstemon scariosus var albifluvis*	C
Humpback Chub	*Gila cypha*	E
Bonytail	*Gila elegans*	E
Colorado Pikeminnow	*Ptychocheilus lucius*	E
Razorback Sucker	*Xyrauchen texanus*	E
Bald Eagle	*Haliaeetus leucocephalus*	T
Yellow-billed Cuckoo	*Coccyzus americanus*	C
Mexican Spotted Owl	*Strix occidentalis lucida*	T
Black-footed Ferret	*Mustela nigripes*	E Experimental
Brown (Grizzly) Bear - Historically?	*Ursus arctos*	T Extirpated
Canada Lynx	*Lynx canadensis*	T

Utah County

Common Name	Scientific Name	Status
Ute Ladies'-tresses	*Spiranthes diluvialis*	T
Deseret Milkvetch	*Astragalus desereticus*	T
Clay Phacelia	*Phacelia argillacea*	E
Utah Valvata Snail - Historically	*Valvata utahensis*	E Extirpated
June Sucker	*Chasmistes liorus*	E
Bald Eagle	*Haliaeetus leucocephalus*	T
Yellow-billed Cuckoo	*Coccyzus americanus*	C
Brown (Grizzly) Bear - Historically	*Ursus arctos*	T Extirpated
Canada Lynx - Possibly	*Lynx canadensis*	T

Wasatch County

Common Name	Scientific Name	Status
Ute Ladies'-tresses	*Spiranthes diluvialis*	T
Bald Eagle	*Haliaeetus leucocephalus*	T
Yellow-billed Cuckoo	*Coccyzus americanus*	C
Brown (Grizzly) Bear - Historically?	*Ursus arctos*	T Extirpated
Canada Lynx	*Lynx canadensis*	T

Washington County

Common Name	Scientific Name	Status
Siler Pincushion Cactus	*Pediocactus sileri*	T
Shivwits or Shem Milkvetch	*Astragalus ampullarioides*	E
Holmgren Milkvetch	*Astragalus holmgreniorum*	E
Dwarf Bearclaw-poppy	*Arctomecon humilis*	E
Virgin River Chub	*Gila seminuda*	E
Woundfin	*Plagopterus argentissimus*	E
Relict Leopard Frog - Historically	*Rana onca*	C Extirpated
Desert Tortoise	*Gopherus agassizii*	T
California Condor	*Gymnogypes californianus*	E Experimental
Bald Eagle	*Haliaeetus leucocephalus*	T
Yellow-billed Cuckoo	*Coccyzus americanus*	C
Mexican Spotted Owl	*Strix occidentalis lucida*	T
Southwestern Willow Flycatcher	*Empidonax traillii extimus*	E
Gray Wolf - Historically	*Canis lupus*	E Extirpated
Brown (Grizzly) Bear - Historically	*Ursus arctos*	T Extirpated

Wayne County

Common Name	Scientific Name	Status
Ute Ladies'-tresses	*Spiranthes diluvialis*	T
Maguire Daisy	*Erigeron maguirei*	T
Barneby Reed-mustard	*Schoenocrambe barnebyi*	E
Winkler Pincushion Cactus	*Pediocactus winkleri*	T
Wright Fishhook Cactus	*Sclerocactus wrightiae*	E
Rabbit Valley Gilia or Wonderland Alice-flower	*Gilia caespitosa*	C
Aquarius Indian Paintbrush	*Castilleja aquariensis*	C
Last Chance Townsendia	*Townsendia aprica*	T
San Rafael Cactus	*Pediocactus despainii*	E
Humpback Chub	*Gila cypha*	E
Bonytail	*Gila elegans*	E
Colorado Pikeminnow	*Ptychocheilus lucius*	E
Razorback Sucker	*Xyrauchen texanus*	E
California Condor - Possibly	*Grus americana*	E Experimental
Bald Eagle	*Haliaeetus leucocephalus*	T
Yellow-billed Cuckoo - Possibly	*Coccyzus americanus*	C
Mexican Spotted Owl	*Strix occidentalis lucida*	T
Southwestern Willow Flycatcher	*Empidonax traillii extimus*	E
Utah Prairie-dog	*Cynomys parvidens*	T

Weber County

Common Name	Scientific Name	Status
Ute Ladies'-tresses	*Spiranthes diluvialis*	T
Ogden Rocky Mountainsnail	*Oreohelix peripherica wasatchensis*	C
June Sucker - Introduced	*Chasmistes liorus*	E
Bald Eagle	*Haliaeetus leucocephalus*	T
Yellow-billed Cuckoo - Possibly	*Coccyzus americanus*	C
Gray Wolf - Historically	*Canis lupus*	T Extirpated
Canada Lynx - Possibly	*Lynx canadensis*	T

DEFINITIONS

E

A taxon that is listed by the U.S. Fish and Wildlife Service as "endangered" with the probability of worldwide extinction.

E Experimental

An "endangered" taxon that is considered by the U.S. Fish and Wildlife Service to be "experimental and non-essential" in its designated use areas in Utah.

E, T, or C Extirpated

An "endangered," "threatened," or "candidate" taxon that is "extirpated" and considered by the U.S. Fish and Wildlife Service to no longer occur in Utah.

E or T Proposed

A taxon "proposed" to be listed as "endangered" or "threatened" by the U.S. Fish and Wildlife Service.

T

A taxon that is listed by the U.S. Fish and Wildlife Service as "threatened" with becoming endangered.

C

A taxon for which the U.S. Fish and Wildlife Service has on file sufficient information on biological vulnerability and threats to justify it being a "candidate" for listing as endangered or threatened.

Note: Please contact the U.S. Fish and Wildlife Service (801-975-3330) for the purpose of consultation under the Endangered Species Act.

R645-301-300 BIOLOGY SECTION

APPENDIX D
MACROINVERTEBRATE STUDIES

- **Preliminary Report on Surveys Conducted to determine Potential Impacts of Rilda Surface Facility Development in Rilda Canyon During 2004, July 2004, by the Utah Department of Natural Resources**
- **Fish and Macroinvertebrate Survey at Rilda Creek, Emery, Utah, Fall 2004, Preliminary Report, Cirrus Ecological Solutions, L.C., November 4, 2004**

PRELIMINARY REPORT ON SURVEYS CONDUCTED TO DETERMINE POTENTIAL IMPACTS OF RILDA SURFACE FACILITY DEVELOPMENT IN RILDA CANYON DURING 2004

Craig A. Walker
Aquatic Biologist

July 2004

Utah Department of Natural Resources
Division of Wildlife Resources
1594 West North Temple, Suite 2110
Salt Lake City, Utah 84114

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Kevin Conway
Director

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Introduction

Subsurface mining operations conducted by Energy West have become less cost-effective due to longer commuting distances (i.e., the need to pay miners for travel time has increased). Additionally, mining operations have become increasingly dangerous as the result of longer commuting distances and a lack of access points for the rescue of miners. For these reasons, Energy West has proposed the development of additional surface facilities in Rilda Canyon. Construction of these facilities would reduce the duration of subsurface commutes undertaken by miners and would provide a more accessible rescue site in the case of accidents. In an effort to identify and reduce potential impacts to biological organisms and their habitat within Rilda Canyon, Energy West has begun to draft an environmental assessment (EA) for this project. In April of 2004, representatives of the Utah Division of Wildlife Resources (UDWR) Southeastern Region were asked by the Utah Division of Oil, Gas, and Mining to participate in an on-site meeting, discuss the impacts of this project on the biota within Rilda Canyon, and aid in the development of a comprehensive EA. During this and subsequent meetings it was decided that UDWR would conduct pre and post-disturbance evaluations of macroinvertebrate populations and identify resident fish populations in Rilda Creek. This preliminary report marks the completion of the pre-disturbance sampling effort. Details on the methodology employed during macroinvertebrate and fish sampling and a limited results section are included in this report. Identification of macroinvertebrates is reliant upon the expertise of Utah State University (USU) personnel and results for this portion of the report are pending. It should be noted that Rilda Creek was believed to be fishless prior to the onset of this study due to the presence of a natural barrier approximately 0.3 km above the confluence of Rilda and Huntington Creeks (Figure 1).

Methods

Site Description and Survey Stations

Rilda Creek (Figure 2) is a small, first-order tributary to Huntington Creek. located in the San Rafael River drainage (Hydrologic Unit #14060009). Three macroinvertebrate sampling sites (Figure 1) were assigned during a preliminary investigation of Rilda Canyon on 24 May, 2004. Macroinvertebrate surveys were then conducted at each of these sites on 28 May; Universal Transverse Mercator (UTM) information collected for these sites should be referenced to the North American Datum 1927 (NAD 27). Sites were not assigned for fish sampling and a continuous single pass survey (Figure 1) was conducted from the confluence of Rilda and Huntington Creeks to an area above the road crossing approximately 3.5 km above the mouth of Rilda Creek on 4 June, 2004 to establish the presence or absence of fish species.

Macroinvertebrate Sampling

Macroinvertebrate sampling within each of the three sites was conducted using a fixed-area sweep (quantitative) and a fixed-time sweep (qualitative). Two quantitative samples were collected using a 0.09 m^2, 500 micron mesh, Surber sampler at each of the first four fast-water habitats encountered moving upstream within each site for a total of eight quantitative samples per site (Table 1). One qualitative sample was collected at each site during a period of 10 minutes using a 500 micron mesh dip net. Habitats were sampled during each qualitative sample for a duration that was proportional to their occurrence within the site. After each quantitative and qualitative sample was taken, sampler or net mesh was rinsed thoroughly over a large plastic bucket to ensure that all inorganic and organic material was collected. Material collected in each sample was then transferred into sample jars labeled with the following information: date, site number, sample type, and sample number. All samples were fixed with 70 - 95% ethanol. Selected habitat data (temperature, conductivity, total dissolved solids, dissolved oxygen, and pH) was collected at each of the three sites.

Electrofishing

Electrofishing surveys were performed using a battery-powered backpack electrofisher. Water flows and clarity were considered adequate for effective sampling. One continuous electrofishing pass was conducted and fish collected were identified to species, enumerated, classified as adult or young-of-the-year according to size, and released.

Macroinvertebrate Sample Pre-sorting

Once samples were collected, DWR personnel rough-sorted (i.e., all material not identified as macroinvertebrate was removed) all samples to reduce the cost of sample processing and hasten the return of results from USU. Quantitative rough-sorted samples were combined for each of the three sites (i.e., eight samples were combined to form one sample for each site). Macroinvertebrate samples were then placed in sample jars, labeled with sampling date, site number, and type of survey (quantitative vs. qualitative). Samples were fixed with 70 - 95% ethanol, and sent to USU for processing. Results of the USU analysis are pending.

Preliminary Results

Electrofishing

Two salmonid species were observed in the section of Rilda Creek surveyed: brown trout *Salmo trutta*, and cutthroat trout *Oncorhynchus clarki*. A single adult brown trout was observed near the mouth of Rilda Creek and 20 cutthroat trout were collected

throughout the section surveyed. Of the cutthroat trout observed, larger (approximately 100 - 250 mm) individuals were found only in the lower reaches (i.e., below a waterfall). Young-of-the-year (approximately 100 mm and smaller) cutthroat trout were found throughout the section surveyed downstream of the road crossing. Although abundance was not measured in this survey, the number of fish collected seemed to diminish as sampling progressed upstream from the waterfall and no fish were found in the upper reach (i.e., above the road crossing) of Rilda Creek.

Discussion and Recommendations

Habitat and Fish

Prior to the onset of this study, United States Forest Service personnel described the presence of a natural barrier (waterfall) to fish passage approximately 0.3 km above the mouth of Rilda Creek. However, upon examination of the waterfall it became apparent that it did not meet the criteria of a complete barrier to salmonid fish passage (generally defined as having height above the water surface no greater than 4 feet when sufficient pool depth is present immediately below the barrier). The height of the waterfall investigated was less than 3 feet above the water surface and a deep (approximately 3 feet) pool was present immediately downstream. Although the definition of a barrier varies by species (due to their different leaping abilities), the height of the waterfall investigated and the presence of fish upstream indicate that the waterfall in Rilda Creek serves only as a seasonal (during low flows) barrier to fish passage. The findings of this survey (viz., the presence of cutthroat trout above the waterfall) were, therefore, not surprising. It should be noted that, since our survey, further investigation has revealed that this seasonal barrier appears to have collapsed and is no longer present. It is likely that the collapse of this seasonal barrier will result in the unhampered upstream movement of cutthroat trout into Rilda Creek, enhancing the size (abundance) of the resident population. Additionally, the lack of a seasonal barrier may also provide additional spawning habitat for salmonids in Huntington Creek; thus, enhancing the mainstem fishery. Efforts should be made to minimize the impacts (e.g., sedimentation, reduction in water quality, etc.) of surface facility construction and operation on fish populations in Rilda Creek. A more intensive fish survey, looking at abundance and size distribution, is planned for next spring to assess the impacts of the barrier collapse on the Rilda populations.

Table 1. – Coordinates for macroinvertebrate sampling locations in Rilda Creek.

Site	Samples	UTM X*	UTM Y*
1	1a, 1b	489765	4362629
	1c, 1d	489765	4362584
	1e, 1f	489764	4362554
	1g, 1h	489723	4362518
2	2a, 2b	487645	4361313
	2c, 2d	487523	4361338
	2e, 2f	487470	4361347
	2g, 2h	487706	4361324
3	3a, 3b	485965	4361583
	3c, 3d	485919	4361569
	3e, 3f	485879	4361670
	3g, 3h	485879	4361671

*NAD 27

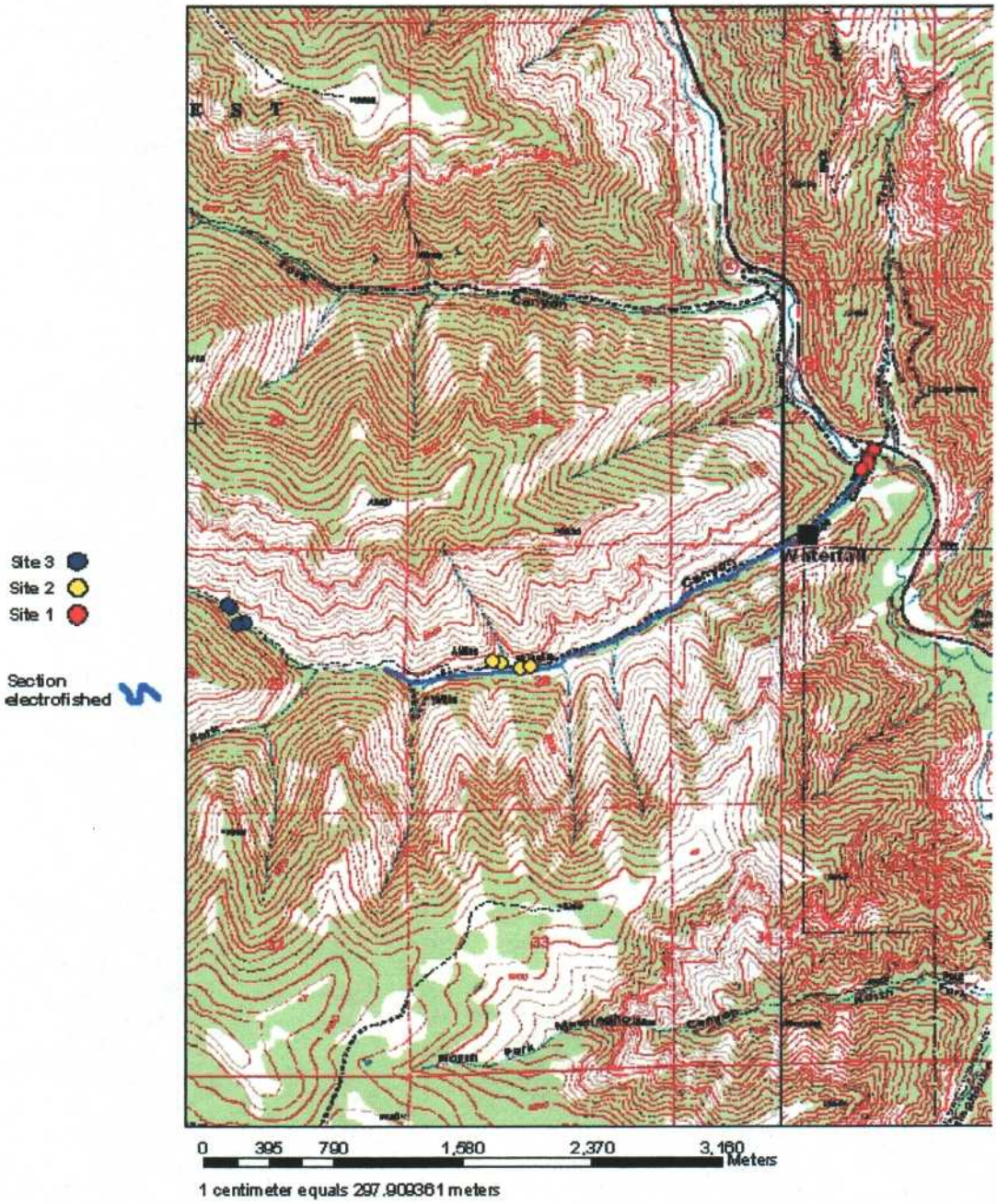

Figure 1. – Waterfall locations, macroinvertebrate sampling sites, and sections sampled for presence or absence of fish species in Rilda Creek.

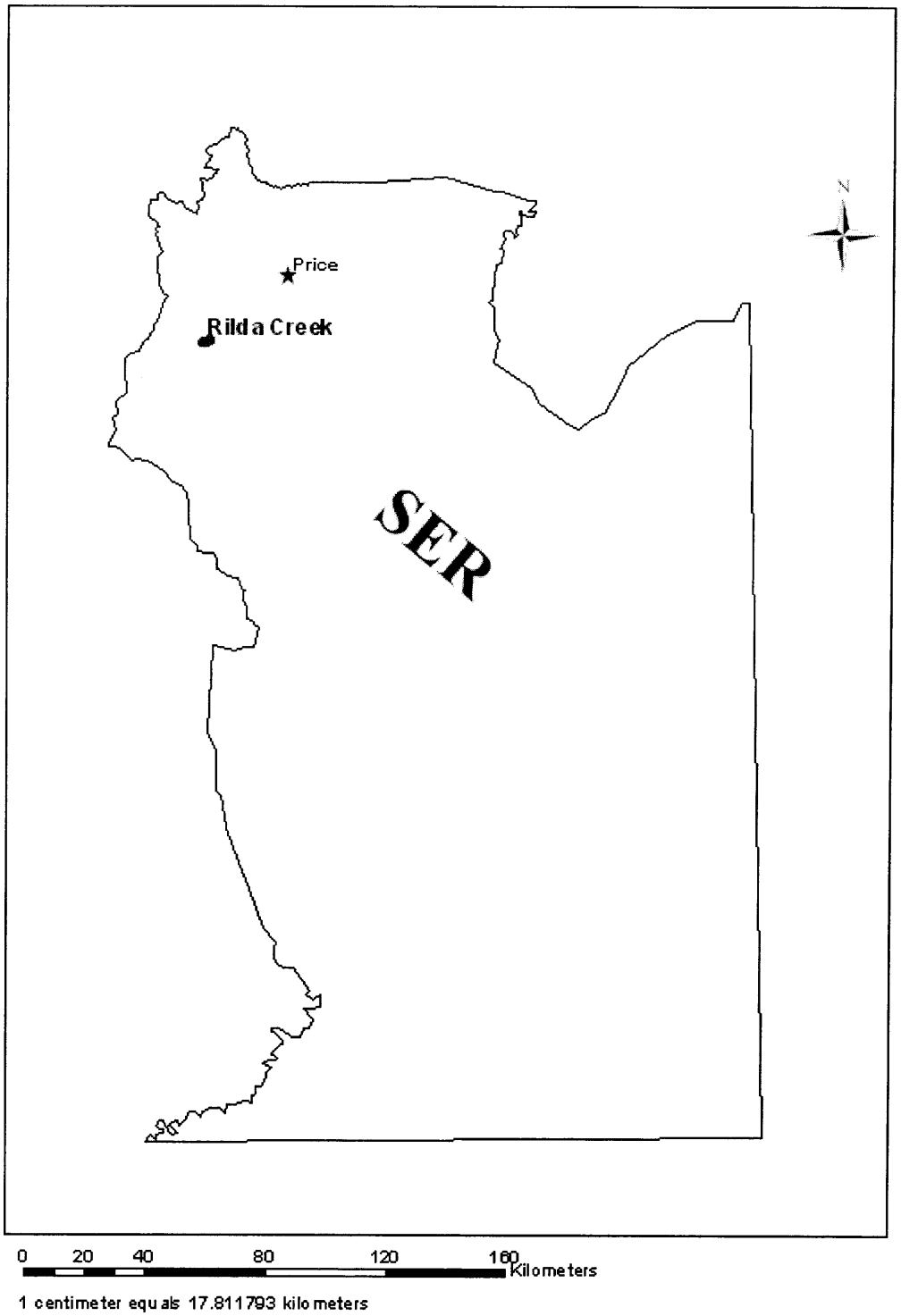

Figure 2. – Location of Rilda Creek within Utah Division of Wildlife Resources Southeastern Region (SER).

Aquatic Invertebrate Report for samples collected in Rilda Creek, Emery County, Utah on 28 May 2004

Report prepared for:
Utah Division of Wildlife Resources, Southeast Region
475 West Price River Drive, Suite C
Price, Utah 84501-2860

Report prepared by:
Mark Vinson
U.S.D.I. Bureau of Land Management
National Aquatic Monitoring Center
Department of Aquatic, Watershed, & Earth Resources
Utah State University
Logan, Utah 84322-5210
435.797.2038

28 September 2004

Sampling Locations

Station ID	Waterbody	County	Latitude (N)	Longitude (W)	Elevation (m)
RILDA-01	Rilda Creek, Site 1	Emery	39.415	111.119	2116
RILDA-02	Rilda Creek, Site 2	Emery	39.4	111.144	2304
RILDA-03	Rilda Creek, Site 3	Emery	39.406	111.163	2402

Methods

Aquatic invertebrates

Qualitative samples—The objective of qualitative invertebrate collections was to collect as many different kinds of invertebrates living at a site as possible. Qualitative collections of invertebrates were done at all sites. Samples were collected with a kicknet (457 x 229 mm) with a 500 micron mesh net and by hand picking invertebrates from woody debris and large boulders. All major habitat types (e.g., riffles, pools, back waters, macrophyte beds) were sampled and all samples were composited to form a single sample from each site on each sampling date

Quantitative samples—The objective of quantitative invertebrate sampling was to collect the more common invertebrates at a site and estimate their relative abundances. Quantitative samples were collected using a Surber net (0.09 m^2) with a 500 micron mesh net. Samples were collected by disturbing the area within the square sampling frame with

our hands and scrubbing individual substrate particles within the sampling area and allowing the invertebrates and detritus to wash downstream into the net. Eight samples were collected in 4 different riffles and composited to make a sample of approximately 0.744 m^2 for each location on each sampling date.

Laboratory methods—The general procedures followed for processing invertebrate samples were similar to those recommended by the United States Geological Survey (Cuffney et al. 1993) and are described in greater detail and rationalized in Vinson and Hawkins (1996). Methods for individual samples are presented in Table 2. All samples were processed in their entirety, i.e., all the organisms were removed and identified. All the organisms removed during the sorting process were then identified. An effort was made to identify all organisms to a consistent taxonomic level. The major identification references used to identify the taxon are listed in the literature-cited section. Once the data were entered into a computer and checked, the remaining debris from the sample was discarded. The identified portion of the sample was placed in 70% ethanol, given a catalog number, and was retained in our permanent collection. Samples are stored in 70% ethanol in glass screw-top vials with threaded screw-on lids and polypropylene liners. Sample labels are written in pencil on waterproof paper. Information on each label includes the sampling location, sampling date and a unique catalog number. Samples are stored sequentially. Future retrieval of the data or samples is quick and easy.

Table 3. The percentage of each sample processed and the total number of invertebrates identified for each sample are reported. In the Station ID, QUAN refers to quantitative samples and QUAL refers to qualitative samples.

Sample ID	Station ID	Sampling Date	% of sample Processed	Invertebrates identified
122328	RILDA-01-QUAN	28-May-2004	100	88
122329	RILDA-01-QUAL	28-May-2004	100	164
122330	RILDA-02-QUAN	28-May-2004	100	74
122331	RILDA-02-QUAL	28-May-2004	100	175
122332	RILDA-03-QUAN	28-May-2004	100	54
122333	RILDA-03-QUAL	28-May-2004	100	259

Data summarization

A number of metrics or ecological summaries were provided for each sampling station. These metrics were calculated as follows:

Taxa richness - Richness is a component and estimate of community structure and stream health based on the number of distinct taxa. Taxa richness normally decreases with decreasing water quality. In some situations organic enrichment can cause an increase in the number of pollution tolerant taxa. Taxa richness was calculated for operational taxonomic units (OTUs) and the number of unique genera or families. The values for operational taxonomic units may be overestimates of the true taxa richness at a site if individuals were the same taxon as those identified to lower taxonomic levels or they may be underestimates of the true taxa richness if multiple taxa were present within a larger taxonomic grouping but were not identified. All individuals within all samples were generally identified similarly, so that comparisons in operational taxonomic richness among samples within this dataset are appropriate, but comparisons to other data sets may not. Comparisons to other datasets should be made at the genera or family level.

Abundance - The abundance, density, or number of aquatic macroinvertebrates per unit area is an indicator of habitat availability and fish food abundance. Abundance may be reduced or increased depending on the type of impact or pollutant. Increased organic enrichment typically causes large increases in abundance of pollution tolerant taxa. High flows, increases in fine sediment, or the presence of toxic substances normally cause a decrease in invertebrate abundance. Invertebrate abundance is presented as the number of individuals per square meter for quantitative samples and the number of individuals collected for qualitative samples.

EPT - A summary of the taxa richness and abundance among the insect Orders Ephemeroptera, Plecoptera, and Trichoptera (EPT). These orders are commonly considered sensitive to pollution.

Number of families - All families are separated and counted. The number of families normally decreases with decreasing water quality.

Percent taxon or family dominance – An assemblage dominated by a single taxon or several taxa from the same family suggests environmental stress.

Shannon Diversity Index - Ecological diversity is a measure of community structure defined by the relationship between the number of distinct taxa and their relative abundances. The Shannon diversity index was calculated for each sampling location for which there were a sufficient number of individuals and taxa collected to perform the calculations. The calculations were made following Ludwig and Reynolds (1988, equation 8.9, page 92).

Evenness - Evenness is a measure of the distribution of taxa within a community. The evenness index used in this report was calculated following Ludwig and Reynolds (1988, equation 8.15, page 94). Value ranges from 0-1 and approach zero as a single taxa becomes more dominant.

Biotic indices - Biotic indices use the indicator taxa concept. Taxa are assigned water quality tolerance values based on their specific tolerances to pollution. Scores are typically weighted by taxa relative abundance. In the United States the most commonly used biotic index is the Hilsenhoff Biotic Index (Hilsenhoff 1987, Hilsenhoff 1988). The Hilsenhoff Biotic Index (HBI) summarizes the overall pollution tolerances of the taxa collected. This index has been used to detect nutrient enrichment, high sediment loads, low dissolved oxygen, and thermal impacts. It is best at detecting organic pollution. Families were assigned an index value from 0- taxa normally found only in high quality unpolluted water, to 10- taxa found only in severely polluted waters. Family level values were taken from Hilsenhoff (1987, 1988) and a family level HBI was calculated for each sampling location for which there were a sufficient number of individuals and taxa collected to perform the calculations. Sampling locations with HBI values of 0-2 are considered clean, 2-4 slightly enriched, 4-7 enriched, and 7-10 polluted. Rather than using mean HBI values for a sample, taxon HBI values can also be used to determine the number of pollution intolerant and tolerant taxa occurring at a site. In this report taxa with HBI values of 0-2 were considered intolerant clean water taxa and taxa with HBI values of 9-10 were considered pollution tolerant taxa. The number of tolerant and intolerant taxa and the abundances of tolerant and intolerant taxa were calculated for each sampling location.

USFS Community tolerant quotient - This index has been widely used by the USFS and BLM throughout the western United States. Taxa are assigned a tolerant

quotient (TQ) from 2-taxa found only in high quality unpolluted water, to 108 - taxa found in severely polluted waters. TQ values were developed by Winget and Mangum (1979). The dominance weighted community tolerance quotient (CTQd) was calculated. Values can vary from about 20 to 100, in general the lower the value the better the water quality.

Functional feeding group measures – A common classification scheme for aquatic macroinvertebrates is to categorize them by feeding acquisition mechanisms. Categories are based on food particle size and food location, e.g., suspended in the water column, deposited in sediments, leaf litter, or live prey. This classification system reflects the major source of the resource, either within the stream itself or from riparian or upland areas and the primary location, either erosional or depositional habitats. The number of taxa and individuals of the following feeding groups were calculated for each sampling location.

Shredders - Shredders use both living vascular hydrophytes and decomposing vascular plant tissue - coarse particulate organic matter (CPOM). Shredders are sensitive to changes in riparian vegetation. Shredders can be good indicators of toxicants that adhere to organic matter.

Scrapers - Scrapers feed on periphyton - attached algae and associated material. Scraper populations increase with increasing abundance of diatoms and can decrease as filamentous algae, mosses, and vascular plants increase. Scrapers decrease in relative abundance in response to sedimentation and organic pollution.

Collector-filterers - Collector-filterers feed on suspended fine particulate organic matter (FPOM). Collector-gatherers are sensitive to toxicants in the water column and deposited in sediments.

Collector-gatherers - Collector-gatherers feed on deposited fine particulate organic matter. Collector-gatherers are sensitive to deposited toxicants.

Predators - Predators feed on living animal tissue.

Unknown feeding group - This category includes taxa that are highly variable, parasites, and those that for which the primary feeding mode is currently unknown.

Clinger taxa - The number of Aclinger@ taxa have been found by Karr and Chu (1998) to respond negatively to human disturbance. Clinger taxa were determined using

information in Merritt and Cummins (1996). These taxa typically cling to the tops of rocks and are thought to be reduced by sedimentation or abundant algal growths

Long-live taxa – The number of long-lived taxa was calculated the number of taxa collected that typically have 2-3 year life cycles. Disturbances and water quality and habitat impairment typically reduces the number of long-lived taxa Karr and Chu (1998). Life-cycle length determinations were based on information in Merritt and Cummins (1996) and Dr. Mark Vinson's knowledge of the invertebrate fauna of Utah.

Results

Abundance data are reported as the estimated number of individuals per square meter for quantitative samples and the estimated number of individuals collected for qualitative samples. Taxa richness data are the number per sample. NC = Not calculated. * = unable to calculate. EPT = totals for the insect orders, Ephemeroptera, Plecoptera, Trichoptera.

General Assemblage Measures

Station	Date	Sample ID	Total abundance	EPT abundance	Number of families	Dominant family	Dominant Family abundance	Dominant Family % contribution
RILDA-01	28-May-2004	122328	118	66	9	Baetidae	38	32.2
RILDA-01-QL	28-May-2004	122329	164	125	10	Baetidae	84	51.22
RILDA-02	28-May-2004	122330	99	67	10	Baetidae	34	34.34
RILDA-02-QL	28-May-2004	122331	175	160	11	Baetidae	89	50.86
RILDA-03	28-May-2004	122332	73	43	8	Baetidae	35	47.95
RILDA-03-QL	28-May-2004	122333	259	213	8	Baetidae	169	65.25
Mean			148	112	9		75	50.56

Diversity Indices

Station	Sampling Date	Sample ID	Total Taxa Richness	EPT Taxa Richness	Shannon Diversity	Simpson Diversity	Evenness
RILDA-01	28-May-2004	122328	14	9	1.97	0.192	0.684
RILDA-01-QL	28-May-2004	122329	14	8	2.042	0.194	0.618
RILDA-02	28-May-2004	122330	13	9	1.963	0.188	0.706
RILDA-02-QL	28-May-2004	122331	19	12	1.805	0.288	0.485
RILDA-03	28-May-2004	122332	11	4	1.675	0.279	0.596
RILDA-03-QL	28-May-2004	122333	11	4	1.142	0.462	0.546
Mean			13.7	7.7	1.766	0.267	0.606

Biotic Indices

Station	Date	Sample ID	Hilsenhoff Biotic Index	Indication	CTQa	CTQd
RILDA-01	28-May-2004	122328	2.72	Slight organic enrichment	75	84
RILDA-01-QL	28-May-2004	122329	3.64	Slight organic enrichment	78	77
RILDA-02	28-May-2004	122330	2.45	Slight organic enrichment	63	64
RILDA-02-QL	28-May-2004	122331	3.21	Slight organic enrichment	67	59
RILDA-03	28-May-2004	122332	3.35	Slight organic enrichment	73	72
RILDA-03-QL	28-May-2004	122333	4.28	Moderate organic enrichment	69	76
Mean			3.28		71	72

Taxa richness and relative abundance values with respect to tolerance or intolerance to pollution were based on the Hilsenhoff Biotic Index (HBI). Intolerant taxa are those taxa given a HBI score of 0, 1, or 2. Tolerant taxa are those taxa given a HBI score of 8, 9, or 10. Abundance data are presented as the estimated number per square meter for quantitative samples and the estimated number of individuals collected for qualitative samples. Taxa richness data are presented as the number of taxa per sample. Numbers in parentheses are percentages of the total.

			Intolerant				Tolerant	
Station	Date	Sample ID	Richness		Abundance		Richness	Abundance
RILDA-01	28-May-2004	122328	2	(14)	3	(3)	0	0
RILDA-01-QUAL	28-May-2004	122329	2	(14)	6	(4)	0	0
RILDA-02	28-May-2004	122330	6	(46)	17	(17)	0	0
RILDA-02-QUAL	28-May-2004	122331	6	(32)	41	(23)	0	0
RILDA-03	28-May-2004	122332	1	(9)	1	(1)	0	0
RILDA-03-QUAL	28-May-2004	122333	2	(18)	2	(1)	0	0
Mean			3		12		0	0

Functional feeding groups

Taxa richness by functional feeding group. Data are presented as the number of taxa collected. Numbers in parentheses are percentages of the total.

Station	Sampling Date	Sample ID	Shredders	Scrapers	Collector filterers	Collector gatherers	Predators	Unknown
RILDA-01	28-May-2004	122328	3 (21)	2 (14)	2 (14)	6 (43)	1 (7)	0 0
RILDA-01-QUAL	28-May-2004	122329	2 (14)	1 (7)	2 (14)	5 (36)	3 (21)	1 (7)
RILDA-02	28-May-2004	122330	3 (23)	3 (23)	0 0	4 (31)	3 (23)	0 0
RILDA-02-QUAL	28-May-2004	122331	2 (11)	4 (21)	2 (11)	6 (32)	4 (21)	1 (5)
RILDA-03	28-May-2004	122332	2 (18)	3 (27)	0 0	5 (45)	1 (9)	0 0
RILDA-03-QUAL	28-May-2004	122333	1 (9)	2 (18)	0 0	3 (27)	4 (36)	1 (9)
Mean			2 (16)	3 (18)	1 (7)	5 (35)	3 (20)	1 (4)

Invertebrate abundance by functional feeding group. Data are presented as the estimated number of individuals per square meter. Numbers in parentheses are percentages of the total.

Station	Sampling Date	Sample ID	Shredders	Scrapers	Collector filterers	Collector gatherers	Predators	Unknown
RILDA-01	28-May-2004	122328	8 (7)	4 (3)	20 (17)	85 (72)	1 (1)	0 0
RILDA-01-QUAL	28-May-2004	122329	6 (4)	9 (5)	19 (12)	120 (73)	7 (4)	3 (2)
RILDA-02	28-May-2004	122330	11 (11)	23 (23)	0 0	58 (59)	8 (8)	0 0
RILDA-02-QUAL	28-May-2004	122331	4 (2)	47 (27)	2 (1)	100 (57)	21 (12)	1 (1)
RILDA-03	28-May-2004	122332	16 (22)	8 (11)	0 0	47 (64)	1 (1)	0 0
RILDA-03-QUAL	28-May-2004	122333	1 0	43 (17)	0 0	189 (73)	4 (2)	22 (8)
Mean			8 (5)	22 (15)	7 (5)	100 (67)	7 (5)	4 (3)

The 10 metrics thought to be most responsive to human-induced disturbance (Karr and Chu 1998).

Station	Sampling Date	Sample ID	Total Taxa	Ephemeroptera Taxa	Plecoptera Taxa	Trichoptera Taxa	Long-lived Taxa	Intolerant Taxa	% Tolerants	Clinger Taxa	% Contribution Dominant Taxon	% Predators
RILDA-01	05/28/2004	122328	14	6	0	3	0	2	0	5	29.7	0.8
RILDA-01-QUAL	05/28/2004	122329	14	4	1	3	0	2	0	5	39	4.3
RILDA-02	05/28/2004	122330	13	4	2	3	0	6	0	4	34.3	8.1
RILDA-02-QUAL	05/28/2004	122331	19	7	3	2	0	6	0	8	50.3	12
RILDA-03	05/28/2004	122332	11	3	0	1	0	1	0	2	47.9	1.4
RILDA-03-QUAL	05/28/2004	122333	11	3	0	1	1	2	0	3	65.3	1.5
Mean			14	5	1	2	0	3	0	5	47.9	4.7

List of taxa collected in 6 samples at sites listed in Table 1. Samples were collected on 28 May 2004. Abundance data are presented as the mean number of individuals among all samples.

Order	Family	Subfamily/Genus/species	Average abundance
Phylum: Annelida			
Class: Oligochaeta			14.02
Phylum: Arthropoda			
Class: Insecta			
Coleoptera	Dytiscidae		0.17
Diptera			0.17
Diptera	Chironomidae		0.89
Diptera	Chironomidae	Orthocladiinae	4.22
Diptera	Chironomidae	Tanypodinae	0.50
Diptera	Empididae	Chelifera	4.17
Diptera	Empididae	Oreogeton	0.22
Diptera	Ptychopteridae	Ptychoptera	0.67
Diptera	Simuliidae	Simulium	3.46
Diptera	Tipulidae		2.63
Diptera	Tipulidae	Dicranota	0.17
Diptera	Tipulidae	Ormosia	0.90
Diptera	Tipulidae	Tipula	2.63
Ephemeroptera	Ameletidae	Ameletus	3.40
Ephemeroptera	Baetidae		0.22
Ephemeroptera	Baetidae	Baetis	70.75
Ephemeroptera	Baetidae	Diphetor hageni	3.72
Ephemeroptera	Ephemerellidae	Drunella	1.73
Ephemeroptera	Heptageniidae		0.17
Ephemeroptera	Heptageniidae	Cinygmula	16.81
Ephemeroptera	Heptageniidae	Epeorus	3.68
Lepidoptera			0.22
Plecoptera	Nemouridae	Amphinemura	0.56
Plecoptera	Perlodidae		2.28
Plecoptera	Perlodidae	Isoperla	2.00
Trichoptera	Hydropsychidae	Hydropsyche	3.40
Trichoptera	Limnephilidae	Hesperophylax	1.62
Trichoptera	Rhyacophilidae	Rhyacophila	0.39
Trichoptera	Rhyacophilidae	Rhyacophila harmstoni	1.40
Trichoptera	Uenoidae	Oligophlebodes	0.22
Phylum: Mollusca			
Class: Gastropoda			
Basommatophora	Planorbidae		0.45
Phylum: Platyhelminthes			
Class: Turbellaria			0.22
A total of 33 taxa were collected in 6 samples.			148.05

List of taxa collected in 6 samples. Samples were collected on 28 May 2004. Count is the total number of individuals identified and retained.

Taxon	Count
Annelida	
Oligochaeta	69
Arthropoda	
Insecta	
Coleoptera	
Dytiscidae	1
Diptera	1
Chironomidae	5
Orthocladiinae	25
Tanypodinae	3
Empididae	
Chelifera	25
Oreogeton	1
Ptychopteridae	
Ptychoptera	3
Simuliidae	
Simulium	18
Tipulidae	12
Dicranota	1
Ormosia	4
Tipula	13
Ephemeroptera	
Ameletidae	
Ameletus	19
Baetidae	1
Baetis	398
Diphetor hageni	22
Ephemerellidae	
Drunella	9
Heptageniidae	1
Cinygmula	95
Epeorus	20
Lepidoptera	1
Plecoptera	
Nemouridae	
Amphinemura	3
Perlodidae	13
Isoperla	12
Trichoptera	
Hydropsychidae	
Hydropsyche	18
Limnephilidae	
Hesperophylax	8
Rhyacophilidae	
Rhyacophila	2
Rhyacophila harmstoni	7
Uenoidae	
Oligophlebodes	1
Mollusca	
Gastropoda	
Basommatophora	
Planorbidae	2
Platyhelminthes	

Taxa list continued.

Taxon	Count
Turbellaria	1
	---
33 Taxa	814 individuals

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Taxa Lists for Individual Samples

Taxonomic list and abundances of aquatic invertebrates collected 28 May 2004 at station RILDA-01, Rilda Creek, Emery County, Utah. The sample was collected from riffle habitat using a Surber sampler. The total area sampled was 0.744 square meters. The sample identification number is 122328. The percentage of the sample that was identified and retained was 100% of the collected sample. A total of 88 individuals were removed, identified and retained. Abundance data are presented as the estimated number of individuals per square meter. Notes - identification to genus or species was not supported because: I - immature organisms, D - damaged organisms, M - poor slide mount, G - gender, U - indistinct characters or distribution, R - retained in our reference collection.

Order	Family	Subfamily/Genus/species	Life Stage	Abundance	Notes
Phylum: Annelida					
Class: Oligochaeta			adult	35	
Phylum: Arthropoda					
Class: Insecta					
Diptera	Ptychopteridae	Ptychoptera	larvae	4	
Diptera	Simuliidae	Simulium	larvae	11	
Diptera	Tipulidae	Tipula	larvae	1	
Ephemeroptera	Ameletidae	Ameletus	larvae	1	
Ephemeroptera	Baetidae		larvae	1	I
Ephemeroptera	Baetidae	Baetis	larvae	35	
Ephemeroptera	Baetidae	Diphetor hageni	larvae	1	
Ephemeroptera	Heptageniidae	Cinygmula	larvae	3	
Ephemeroptera	Heptageniidae	Epeorus	larvae	8	
Lepidoptera			larvae	1	Terrestrial
Trichoptera	Hydropsychidae	Hydropsyche	larvae	9	
Trichoptera	Limnephilidae	Hesperophylax	larvae	5	
Trichoptera	Rhyacophilidae	Rhyacophila harmstoni	larvae	1	

Total: 14 taxa				118 individuals	

Taxonomic list and abundances of aquatic invertebrates collected 28 May 2004 at station RILDA-01, Rilda Creek, Emery County, Utah. The sample was collected from multiple habitats using a dip net. The total area sampled was unspecified. The sample identification number is 122329. The percentage of the sample that was identified and retained was 100% of the collected sample. A total of 164 individuals were removed, identified and retained. Abundance data are presented as the estimated number of individuals collected in the entire sample. Notes - identification to genus or species was not supported because: I - immature organisms, D - damaged organisms, M - poor slide mount, G - gender, U - indistinct characters or distribution, R - retained in our reference collection.

Order	Family	Subfamily/Genus/species	Life Stage	Abundance	Notes
Phylum: Annelida					
Class: Oligochaeta			adult	19	
Phylum: Arthropoda					
Class: Insecta					
Diptera	Chironomidae	Orthocladiinae	larvae	4	
Diptera	Chironomidae	Tanypodinae	larvae	1	
Diptera	Empididae	Chelifera	larvae	3	
Diptera	Simuliidae	Simulium	larvae	9	
Diptera	Tipulidae	Tipula	larvae	3	
Ephemeroptera	Baetidae	Baetis	larvae	64	
Ephemeroptera	Baetidae	Diphetor hageni	larvae	20	
Ephemeroptera	Heptageniidae	Cinygmula	larvae	9	
Ephemeroptera	Heptageniidae	Epeorus	larvae	13	
Plecoptera	Perlodidae		larvae	5	U
Trichoptera	Hydropsychidae	Hydropsyche	larvae	10	
Trichoptera	Limnephilidae	Hesperophylax	larvae	3	
Trichoptera	Rhyacophilidae	Rhyacophila harmstoni	larvae	1	

Total: 14 taxa				164 individuals	

Taxonomic list and abundances of aquatic invertebrates collected 28 May 2004 at station RILDA-02, Rilda Creek, Emery County, Utah. The sample was collected from riffle habitat using a Surber sampler. The total area sampled was 0.744 square meters. The sample identification number is 122330. The percentage of the sample that was identified and retained was 100% of the collected sample. A total of 74 individuals were removed, identified and retained. Abundance data are presented as the estimated number of individuals per square meter. Notes - identification to genus or species was not supported because: I - immature organisms, D - damaged organisms, M - poor slide mount, G - gender, U - indistinct characters or distribution, R - retained in our reference collection.

Order	Family	Subfamily/Genus/species	Life Stage	Abundance	Notes
Phylum: Annelida					
Class: Oligochaeta			adult	22	
Phylum: Arthropoda					
Class: Insecta					
Diptera	Chironomidae		pupae	1	
Diptera	Tipulidae	Tipula	larvae	8	
Ephemeroptera	Ameletidae	Ameletus	larvae	4	
Ephemeroptera	Baetidae	Baetis	larvae	34	
Ephemeroptera	Ephemerellidae	Drunella	larvae	4	I
Ephemeroptera	Heptageniidae	Cinygmula	larvae	15	
Plecoptera	Nemouridae	Amphinemura	larvae	1	
Plecoptera	Perlodidae		larvae	3	U
Trichoptera	Limnephilidae	Hesperophylax	larvae	1	
Trichoptera	Rhyacophilidae	Rhyacophila	larvae	1	I
Trichoptera	Rhyacophilidae	Rhyacophila harmstoni	larvae	4	
Phylum: Platyhelminthes					
Class: Turbellaria			adult	1	

Total: 13 taxa				99 individuals	

Taxonomic list and abundances of aquatic invertebrates collected 28 May 2004 at station RILDA-02, Rilda Creek, Emery County, Utah. The sample was collected from multiple habitats using a dip net. The total area sampled was unspecified. The sample identification number is 122331. The percentage of the sample that was identified and retained was 100% of the collected sample. A total of 175 individuals were removed, identified and retained. Abundance data are presented as the estimated number of individuals collected in the entire sample. Notes - identification to genus or species was not supported because: I - immature organisms, D - damaged organisms, M - poor slide mount, G - gender, U - indistinct characters or distribution, R - retained in our reference collection.

Order	Family	Subfamily/Genus/species	Life Stage	Abundance	Notes
Phylum: Annelida					
Class: Oligochaeta			adult	6	
Phylum: Arthropoda					
Class: Insecta					
Diptera			larvae	1	U
Diptera	Chironomidae		pupae	1	
Diptera	Chironomidae	Orthocladiinae	larvae	3	
Diptera	Chironomidae	Tanypodinae	larvae	1	
Diptera	Simuliidae	Simulium	larvae	1	
Diptera	Tipulidae	Tipula	larvae	2	
Ephemeroptera	Ameletidae	Ameletus	larvae	15	
Ephemeroptera	Baetidae	Baetis	larvae	88	
Ephemeroptera	Baetidae	Diphetor hageni	larvae	1	
Ephemeroptera	Ephemerellidae	Drunella	larvae	4	I
Ephemeroptera	Heptageniidae		larvae	1	I
Ephemeroptera	Heptageniidae	Cinygmula	larvae	27	
Ephemeroptera	Heptageniidae	Epeorus	larvae	1	
Plecoptera	Nemouridae	Amphinemura	larvae	2	
Plecoptera	Perlodidae		larvae	6	I,U
Plecoptera	Perlodidae	Isoperla	larvae	12	
Trichoptera	Hydropsychidae	Hydropsyche	larvae	1	
Trichoptera	Rhyacophilidae	Rhyacophila harmstoni	larvae	2	

Total: 19 taxa				175 individuals	

Taxonomic list and abundances of aquatic invertebrates collected 28 May 2004 at station RILDA-03, Rilda Creek, Emery County, Utah. The sample was collected from riffle habitat using a Surber sampler. The total area sampled was 0.744 square meters. The sample identification number is 122332. The percentage of the sample that was identified and retained was 100% of the collected sample. A total of 54 individuals were removed, identified and retained. Abundance data are presented as the estimated number of individuals per square meter. Notes - identification to genus or species was not supported because: I - immature organisms, D - damaged organisms, M - poor slide mount, G - gender, U - indistinct characters or distribution, R - retained in our reference collection.

Order	Family	Subfamily/Genus/species	Life Stage	Abundance	Notes
Phylum: Annelida					
Class: Oligochaeta			adult	3	
Phylum: Arthropoda					
Class: Insecta					
Diptera	Chironomidae	Orthocladiinae	larvae	1	
Diptera	Empididae	Oreogeton	larvae	1	
Diptera	Tipulidae		larvae	15	U
Diptera	Tipulidae	Ormosia	larvae	5	
Diptera	Tipulidae	Tipula	larvae	1	
Ephemeroptera	Baetidae	Baetis	larvae	35	
Ephemeroptera	Ephemerellidae	Drunella	larvae	1	I
Ephemeroptera	Heptageniidae	Cinygmula	larvae	5	
Trichoptera	Uenoidae	Oligophlebodes	larvae	1	
Phylum: Mollusca					
Class: Gastropoda					
Basommatophora	Planorbidae		adult	3	

Total: 11 taxa				73 individuals	

Taxonomic list and abundances of aquatic invertebrates collected 28 May 2004 at station RILDA-03, Rilda Creek, Emery County, Utah. The sample was collected from multiple habitats using a dip net. The total area sampled was unspecified. The sample identification number is 122333. The percentage of the sample that was identified and retained was 100% of the collected sample. A total of 259 individuals were removed, identified and retained. Abundance data are presented as the estimated number of individuals collected in the entire sample. Notes - identification to genus or species was not supported because: I - immature organisms, D - damaged organisms, M - poor slide mount, G - gender, U - indistinct characters or distribution, R - retained in our reference collection.

Order	Family	Subfamily/Genus/species	Life Stage	Abundance	Notes
Phylum: Arthropoda					
Class: Insecta					
Coleoptera	Dytiscidae		adult	1	U
Diptera	Chironomidae		pupae	3	
Diptera	Chironomidae	Orthocladiinae	larvae	17	
Diptera	Chironomidae	Tanypodinae	larvae	1	
Diptera	Empididae	Chelifera	larvae	22	
Diptera	Tipulidae		larvae	1	U
Diptera	Tipulidae	Dicranota	larvae	1	
Ephemeroptera	Baetidae	Baetis	larvae	169	
Ephemeroptera	Ephemerellidae	Drunella	larvae	1	I
Ephemeroptera	Heptageniidae	Cinygmula	larvae	42	
Trichoptera	Rhyacophilidae	Rhyacophila	larvae	1	

Total: 11 taxa				259	individuals

FISH AND MACROINVERTEBRATE SURVEY AT RILDA CREEK, EMERY, UTAH. FALL 2004. PRELIMINARY REPORT

Ernesto A. de la Hoz

Aquatic Ecologist

Preliminary Report to the Energy West Mining Company

Cirrus Ecological Solutions, L.C.

965 South 100 West, Suite 200

Logan, Utah 84321

November 04, 2004

FISH AND MACROINVERTEBRATE SURVEY AT RILDA CREEK, EMERY, UTAH. FALL 2004. PRELIMINARY REPORT

Introduction

Increases in the cost of surface mining operations, as well as the increased risk for miners caused by long commuting distances and lack of access points for rescue activities, has lead Energy West Mining Company to propose a mine development project in Rilda Canyon. The portal in Rilda Canyon provides an additional entry to the mine, and reduces the commute time and risk for the miners.

The construction of the portal required the diversion of 1,200 feet of Rilda Creek into a culvert, which can disturb aquatic macroinvertebrate communities. Energy West is currently working on a draft environmental assessment (EA) to identify potential negative effects and minimize the impacts of the new development on the biota of Rilda Canyon. The Utah Division of Wildlife Resources (UDWR), the Utah Division of Oil Gas and Mining, the Forest Service, and the Bureau of Land Management are contributing to the development of a comprehensive EA.

To assess potential impacts on aquatic organisms and their habitat, the UDWR Southeast Region conducted a pre-disturbance evaluation of macroinvertebrate and fish communities in Rilda Creek. The purpose of this survey is to conduct a pre- and-post disturbance assessment of the macroinvertebrate community and fish populations based on the work conducted by the UDWR during May 2004. This report includes a description of the methodology used, results and discussion of the fish survey. Macroinvertebrate samples have been submitted for analysis to the National Aquatic Monitoring Center at Utah State University. Results from these analyses are pending.

Methods

Study Area

Rilda Creek is a small first-order stream tributary to Huntington Creek. This stream is located in the San Rafael River Drainage (Hydrologic Unit #14060009) within the Manti La-Sal National Forest. Historically, mining has been a major management activity in this area. The current Forest Plan identifies this area as appropriate for mineral development. Three sampling sites were selected during the preliminary assessment at Rilda Canyon (Walker 2004). Site 1 is located near the confluence with Huntington Creek, Sites 2 and 3 are located approximately 2.3 Km and 4.3 Km respectively, above the mouth of Rilda Creek. Elevation ranges from 2116 m at Site 1 to 2402 m at Site 3.

The fall survey was conducted on October 22, 2004. Invertebrate samples from sites 1 and 2 were collected at the locations previously selected by the UDWR. At the time of the fall survey, there was no flow at Site 3. An alternative sampling site was selected (Site 3A) and the third sample was collected in an area adjacent to the federally restricted zone for culinary water use (Figure 1).

Macroinvertebrate Sampling

Two types of macroinvertebrate samples were collected. A quantitative sample was collected using a 500 um Surber sampler (surface area=0.09 m2). Two samples were collected at the first four fast-water habitat units encountered. All samples were combined at each site (i.e., eight samples per site). Sampling locations were not randomly selected due to the small size of the sampling units. The location of the habitat units sampled is shown in Table 1. In addition, a 10-minute (fixed-time) qualitative sample was collected using a 500 um kick net. This sample was collected within the same reach boundaries as sampled for the quantitative sample. All habitats within the reach were sampled proportionally to their occurrence. Samples were processed in the field following the protocol recommended by the National Aquatic Monitoring Center (http://www.usu.edu/buglab/monitor/sampling.html#Sampling%20Procedures). The material collected

in each sample was preserved using 10% buffered formalin. Selected habitat data was collected (e.g., water temperature, pH, conductivity) at each site.

Fish Survey

A single pass electrofishing survey was conducted from the mouth of Rilda Creek to an area approximately 3 km upstream. A single backpack eletrofisher (Smith-Roth LR-24) was used (electrofisher settings: 30Hz, 150 volts, 400-watt power limit). Stream conditions (i.e., flow and clarity) were adequate for effective sampling. Fish collected were identified, enumerated, and classified according to their size. Fish were allowed to recover in buckets filled with stream water and subsequently released.

Preliminary Results and Discussion

Macroinvertebrate survey

Macroinvertebrate samples have been delivered to the National Aquatic Monitoring Center (USU- Buglab) for processing. Sample processing at the laboratory is expected to be completed within six months. Results from this analysis will be submitted subsequently.

Fish survey

The only two fish species observed were brown trout (*Salmo trutta*) and cutthroat trout (*Oncorhynchus clarki*). A total of 56 adult and sub-adult cutthroat trout, 9 young-of-the-year (YOY), and 1 adult brown trout were observed along Rilda Creek. Of the cutthroat trout observed, 16 had a total length of less than 100mm, 40 fish ranged between 100 and 250 mm, and 9 were less than 50mm. The majority of the fish within the 100-250mm range had a total length less than 150mm. A trend of increasing or decreasing fish abundance along the stream section surveyed was not observed. Groups of 4 to 6 larger fish (adults and sub-adults) were common in plunge pools located along low to middle reaches of the section surveyed. Young-of –the-year (YOY) cutthroats were observed in runs and pools along the stream section. The only brown trout observed during the survey was captured in a pool located approximately 250 m from the mouth of Rilda Creek; this specimen was considerably larger than the adult cutthroat trouts observed.

No fish were observed above the concrete structure located downstream of the road crossing in Rilda Canyon (Figure 1).

The collapsed waterfall described in the previous survey was observed. Walker (2004) noted the potential for upstream movement above this waterfall. The presence of fish above this point suggests that this waterfall does no constitute a barrier for fish movement. However, the absence of fish above the concrete structure located below the road crossing suggests that this structure may pose a limitation for fish movement. The wide and shallow streambed at the road crossing could also prevent further upstream movement of any fish that reaches this point.

The presence of YOY along low to middle reaches of Rilda Creek provided evidence of natural reproduction in Rilda Creek. As suggested by Walker (2004), it is also possible that fish from Huntington Creek could use Rilda Creek as spawning habitat. Although physical characteristics of Rilda Creek (e.g., stream flow, substrate) were not quantified, it was evident that spawning habitat at Rilda Creek is less than optimal due to low flow and high abundance of fine substrates (i.e., sand, silt). Potential effects from the mining operations such as increased sedimentation, reductions in stream flow and water quality should be kept at minimum to ensure the sustainability of the small fish population in Rilda Creek.

References cited

Walker, A.W. 2004. Preliminary repot on surveys conducted to determine potential impacts of Rilda Creek surface facility development in Rilda Canyon during 2004. Utah Department of Natural Resources. Division of Wildlife Resources. Salt Lake City, UT. 9p.

Table 1. UTM coordinates for macroinvertebrate sampling locations in Rilda Creek, Emery, UT.

Site	Samples	UTM X*	UTM Y*
1	1a, 1b	489769	4362610
	1c,1d	489771	4362548
	1e,1f	489764	4362562
	1g, 1h	489727	4362522
2	2a,2b	487709	4361324
	2c,2d	487637	4361290
	2e,2f	487520	4361329
	2g,2h	487467	4361330
3	3a,3b	487093	4361288
	3c,3d	487122	4361293
	3f,3g	487113	4361280
	3g,3h	487096	4361279

* NAD 27

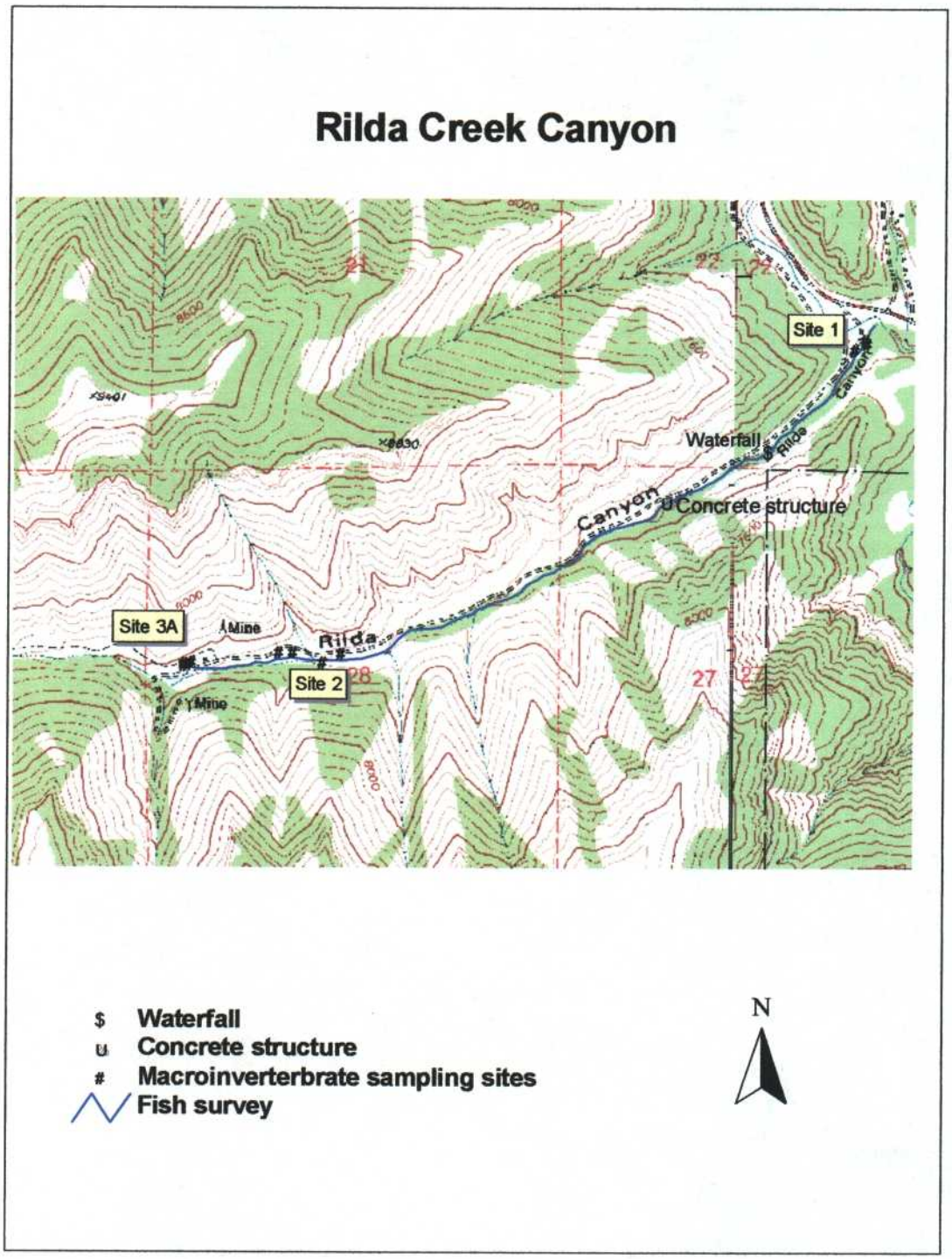


Figure 1. Map of Rilda Creek Canyon, Emery, Utah. Location of macroinvertebrate and fish survey sampling reaches.

R645-301-300 BIOLOGY SECTION

APPENDIX E
SOUND STUDY

♦ **2004 Ventilation Fan Sound Survey**

Rilda Canyon and Mill Fork Canyon Noise Evaluation

November 2004

Prepared by Energy West

Summary

During the Rilda Canyon Portal Facility permitting and National Environmental Policy Act (NEPA) process, governmental agencies requested that PacifiCorp provide noise source analysis related to the proposed expansion Rilda Canyon. The single most contributor to noise in the planned expansion is the installation of a second mine ventilation fan. Typical fan mine installations (either exhausting or blowing) produce approximately 80 dBA at 100' (refer to attached manufactures results). Sound reduces 6 decibels with each doubling of distance as the energy spreads over a larger surface. As a result, mine fan operations is approximately 44 dBA at 1600'. In addition to the requested noise survey, biologist suggested collecting an octave band analysis in Rilda Canyon with its current operating mine fan. PacifiCorp conducted an noise survey including octave band analysis throughout Rilda Canyon on November 22, 23 and 24, 2004 at various times and atmospheric conditions. Surveys were also conducted in Mill Fork Canyon for comparison to an undeveloped scenario.

Survey Methods

PacifiCorp conducted a noise survey utilizing a hand held decimeter at five locations in Rilda Canyon and three locations in Mill Fork Canyon (refer to attached map).

Survey Instrumentation:	Manufacture:	Quest Technologies
	Model Number:	2900
	Serial Number:	CE0080003
	Calibration:	114 dBA

At each station the following information was collected:

Time
Temperature
Estimated wind speed
Total dBA

Octave Band Analysis:	Ranges	31 Hz	1K Hz
		63 Hz	2K Hz
		125 Hz	4K Hz
		250 Hz	8K Hz
		500 Hz	16K Hz

Notes: Any special circumstance was also noted, example: road traffic, air craft in distance.

Survey Results

The primary noise variation at each testing location was based on environmental and human influences. For example, in the upper reaches Mill Fork Canyon, an area without human influences, the primary source of noise was related to wind as a result thermal variations. Near the canyon mouth, the primary noise was related to the proximity of Huntington Creek and associated traffic noise along State Highway 31(refer to attached location map and octave band analysis charts). No human influences were noted other than air crafts in the distance during the survey, except the survey location near Huntington Canyon. Noise peaked at 500 Hz to 2K Hz frequencies ranging from 35 to 61.5 dBA.

In Rilda Canyon, the primary source in the upper reaches was related to the installation of the mine fan in the Left Fork. Noise along the survey locations down canyon from the fan was related to the proximity of Rilda and Huntington creeks and variations in wind (refer to attached location map and octave band analysis charts). No human influences were noted other than air crafts in the distance during the survey, except the survey location near Huntington Canyon. Similar to Mill Fork Canyon, noise in Rilda Canyon peaked 500 Hz to 2K Hz frequencies ranging from 35.0 to 61.0 dBA. Directly across from the mine fan in Rilda Canyon the noise peaked at 250 Hz to 1K Hz frequencies ranging from 75.5 to 77.9 dBA. As stated earlier, sound reduces 6 decibels with each doubling of distance as the energy spreads over a larger surface. Octave band results at the mine gate location (approximately 1600' down canyon from the mine fan) noise peaked at 250 Hz to 1K Hz frequencies ranging from 47.5 to 50.0 dBA (similar to non-mine fan influenced recordings).

For complete octave band analysis refer to attached summary sheets and charts.

Attachments:

ACOUSTICS TERMINOLOGY

TLT-BACOCK, INC. SOUND ANALYSIS
- Blowing Fan
- Exhausting Fan

OCTAVE BAND TESTING LOCATION MAP

MILL FORK CANYON OCTAVE BAND ANALYSIS

RILDA CANYON OCTAVE BAND ANALYSIS

ACOUSTICS TERMINOLOGY

Acoustics Terminology

Taken from "Protective Noise Levels - Condensed Version of EPA Levels Document" EPA Report No. 550/9-79-100, November 1978

ABOUT SOUND

Sound occurs when the air vibrates. The vibration produces alternating bands of relatively dense and sparse particles of air, spreading outward from the source in the same way as ripples do on water after a stone is thrown into it. The result of the movement of the particles is a fluctuation in the normal atmospheric pressure, or sound waves. These waves radiate in all directions from the source and may be reflected and scattered or, like other wave actions, may turn corners. When the source stops vibrating, the sound waves disappear almost instantaneously, and the sound ceases. The ear is extremely sensitive to sound pressure fluctuations, which are converted into auditory sensations.

Sound may be described in terms of three variables:

1. Amplitude (perceived as loudness)
2. Frequency (perceived as pitch)
3. Time pattern

Amplitude

Sound pressure is the amplitude or measure of the difference between atmospheric pressure (with no sound present) and the total pressure (with sound present). Although there are other measures of sound amplitude, sound pressure is the fundamental measure and is the basic ingredient of the various measurement descriptors in the next section, "Measurement of Environmental Noise."

The unit of sound pressure is the decibel dB. The decibel scale is a logarithmic scale, not a linear one, such as the scale of length. The logarithmic scale is used because the range of sound intensities is so great, that it is convenient to compress the scale to encompass all of the sounds that need to be measured. The human ear has an extremely wide range of response to sound amplitude. Sharply painful sound is 10 million times greater in sound pressure than the least audible sound. In decibels, this 10 million to 1 ratio is simplified logarithmically to 140 dB.

Another unusual property of the decibel scale is that the sound pressure levels of two separate sounds are not directly (that is, arithmetically) additive. For example, if a sound of 70 dB is added to another sound of 70 dB, the total is only a 3-decibel increase (to 73 dB), not a doubling to 140 dB. Furthermore, if two sounds are of different levels, the lower level adds less to the higher as this difference increases. If the difference is as much as 10 dB, the lower level adds almost nothing to the higher level. In other words, adding a 60 decibel sound to a 70 decibel sound only increases the total sound pressure level less than one-half decibel.

Frequency

The rate at which a sound source makes the air vibrate determines frequency. The unit of time is usually one second and the term "Hertz" (after an early investigator of the physics of sound) is used to designate the number of cycles per second.

The human ear and that of most animals has a wide range of response. Humans can identify sounds with frequencies from about 16 Hz (Hertz) to 20,000 Hz. Because pure tones are relatively rare in real life situations, most sounds consist instead of a complex mixture of many frequencies.

Time Pattern

The temporal nature of sound may be described in terms of its pattern of time and level: continuity, fluctuation, impulsiveness, and intermittency. Continuous sounds are produced for relatively long periods at a constant level, such as the noise of a waterfall. Intermittent sounds are those which are produced for short periods, such as the ringing of a telephone or aircraft take-offs and landings. Impulse noises are sounds which are produced in an extremely short span of time, such as a pistol shot or a hand clap. Fluctuating sounds vary in level over time, such as the loudness of traffic sounds at a busy intersection.

MEASUREMENT OF ENVIRONMENTAL NOISE: SOUND DESCRIPTORS

EPA has adopted a system of four "sound descriptors" to summarize how people hear sound and to determine the impact of environmental noise on public health and welfare. These four descriptors are: the A-weighted Sound Level, A-weighted Sound Exposure Level, Equivalent Sound Level, and Day-Night Sound Level. They are related, but each is most useful for a particular type of measurement. The descriptions and some examples of their uses are described below.

A-Weighted Sound Level

One's ability to hear a sound depends greatly on the frequency composition of the sound. People hear sounds most readily, when the predominant sound energy occurs at frequencies between 1000 to 6000 Hertz (cycles per second). Sounds at frequencies above 10,000 Hertz (such as high-pitched hissing) are much more difficult to hear, as are sounds at frequencies below about 100 Hz (such as a low rumble). To measure sound on a scale that approximates the way it is heard by people, more weight must be given to the frequencies that people hear more easily.

A method for weighting the frequency spectrum to mimic the human ear was sought for years. Many different scales of sound measurement, including A-weighted sound level (and also B, C, D, and E-weighted sound levels) have evolved in this search. A-weighting was recommended by EPA to describe environmental noise because it is convenient to use, accurate for most purposes, and is used extensively throughout the world.

The A-weighting of frequency is also used in the three descriptors discussed below. When used by itself, an A-weighted decibel value denotes either a sound level at a given instant, a maximum level, or a steady-state level. The following three descriptors are used to summarize those levels which vary over time.

Sound Exposure Level

Since the levels of many sounds change from moment to moment, this variation must also be accounted for when measuring environmental noise. One method for measuring the changing magnitude of sound levels is to trace a line on a sheet of moving paper, so that the movement of the pen is proportional to the sound level in decibels. Sound level may vary with time. The sound may appear to be

characterized by a fairly steady lower level, and individual events that cause intermittent changes. This fairly constant lower level is often called the background ambient sound level.

Each single event has a maximum level. It also has a time pattern. Aircraft noise is above the background ambient level for about a minute, whereas the sound levels from cars are above the background level for much less time.

The duration of sounds with levels that vary from moment to moment is more difficult to characterize. One way is to combine the maximum sound level with the length of time during which the sound level is greater than a certain number of decibels. For example, the number of seconds that the sound rises above the 10 dB down (below maximum) value, determines the sound energy. The total energy of the sound divided by the duration determines the measurement descriptor, sound exposure level (L_S), referred to in the Levels Document as the single event noise exposure level (SENEL). This value represents the total sound energy that is normalized to a one second duration.

Equivalent Sound Level

Yet another method of quantifying the noise environment is to determine the value of steady-state sound which has the same A-weighted sound energy as that contained in the time-varying sound. This is the measurement descriptor, termed the Equivalent Sound Level (L_{eq}). The Equivalent Sound Level is a single value of sound level for any desired duration, which includes all of the time-varying sound energy in the measurement period. An L_{eq} of 58 dB, reflects the sound energy in all the peaks and valleys of the time chart and is equivalent to the energy in a continuous sound of 58 dB.

The major virtue of the Equivalent Sound Level is that it correlates reasonably well with the effects of noise on people, even for wide variations in environmental sound levels and time patterns. It is used when only the durations and levels of sound, and not their times of occurrence (day or night), are relevant and is easily measurable by available equipment. It also is the basis of a fourth and final measurement descriptor of the total outdoor noise environment, the *Day-Night Sound Level* (L_{dn}).

Day-Night Sound Level

The Day-Night Sound Level is the A-weighted equivalent sound level for a 24-hour period with an additional 10 dB weighting imposed on the equivalent sound levels occurring during nighttime hours (10 pm to 7 am). Hence, an environment that has a measured daytime equivalent sound level of 60 dB and a measured nighttime equivalent sound level of 50 dB, can be said to have a weighted nighttime sound level of 60 dB (50+10) and an L_{dn} of 60 dB.

TLT-BACOCK, INC. SOUND ANALYSIS

BLOWING FAN

Sheet #1

TLT-BABCOCK, INC. SOUND ANALYSIS: VER. 1.9S, 8/95

JOB NO:03-00251-M CUST:Energy West Mining FAN SIZE:GA 25/12.6-1
FLOW (ACFM): 454000.0 DENSITY (LB/FT3):.0590 SPEED (R.P.M.):1185.
PRES.(INWG): 11.1 TEMP. (F): 70.0 B.P.F. (HZ.) : 119.

LW = SOUND POWER (RE:10-12 WATTS). LP = SOUND PRESSURE (RE:0.0002 MB).

ONE STAGE AXIAL UNATTENUATED FAN NOISE LEVELS:
** LP LEVELS ARE AT 1 METER FROM THE SURFACE **

TOTAL SOUND POWER LEVELS OF THE FAN: REFERENCE ONLY.

FREQ.(HZ):	31.5	63	125	250	500	1K	2K	4K	8K	16K	TOTAL:
LW (DB):	121	123	129	130	125	124	122	118	114	107	135
LW(DBA):	82	97	113	121	122	124	123	119	113	100	129

NOISE BASED ON AN OPEN INLET AND AN DUCTED OUTLET.

NOISE LEVELS IN THE FAN INLET AIRSTREAM:

FREQ.(HZ):	31.5	63	125	250	500	1K	2K	4K	8K	16K	TOTAL:
LW (DB):	111	115	124	125	120	117	113	107	101	92	129
LW(DBA):	72	89	108	116	117	117	114	108	100	85	123
LP (DB):	96	100	109	110	105	102	98	92	86	77	114
LP(DBA):	57	74	93	101	102	102	99	93	85	70	107

NOISE LEVELS OUTSIDE THE FAN OUTLET DUCT:

FREQ.(HZ):	31.5	63	125	250	500	1K	2K	4K	8K	16K	TOTAL:
LW (DB):	111	111	113	108	102	92	82	85	73	58	118
LW(DBA):	72	85	97	99	99	92	83	86	72	51	104
LP (DB):	90	90	92	87	81	71	61	64	52	37	96
LP(DBA):	51	64	76	78	78	71	62	65	51	30	83

NOISE LEVELS FROM THE FAN CASING: LLIN.= 121.4 237.1

FREQ.(HZ):	31.5	63	125	250	500	1K	2K	4K	8K	16K	TOTAL:
LW (DB):	128	128	129	125	121	118	109	96	86	75	134
LW(DBA):	89	102	113	116	118	118	110	97	85	68	123
LP (DB):	104	104	105	101	97	94	85	72	62	51	110
LP(DBA):	65	78	89	92	94	94	86	73	61	44	99

TOTAL NOISE LEVELS IN THE FAR FIELD: DISTANCE "S" = 152.4 M. = 500'

	DISCHARGE/STACK:	CASING:	OPEN INLET:
LP (DB):	79	88	83
LP(DBA):	70	77	77

RONE1 = 45.7 DB

TLT: .00 .00 .00 1.00 4 85 51.8

ALL NOISE LEVELS ARE FOR THE FREE FIELD CONDITION.
THE LEVELS DO NOT INCLUDE INCREASES FROM MULTIPLE FANS, REVERBERATION, OR REFLECTION.

FAN SOUND PRESSURE @ 500' FROM THE FAN, CAUSED by THE NOISE COMING FROM THE FAN CASING (HOUSING) without ANY NOISE INSULATION FOR THE FAN HOUSING.
See following page for the ATTENUATION THAT CAN be achieved with ACOUSTIC INSULATION (2" to 10" Thick) with & without RUBBER.

Sheet #2

TLT-BABCOCK, INC. SOUND ANALYSIS: VER. 1.9S, 8/95

JOB NO:03-00251-M CUST:Energy West Mining FAN SIZE:GA 25/12.6-1
FLOW (ACFM): 454000.0 DENSITY (LB/FT3):.0590 SPEED (R.P.M.):1185.
PRES.(INWG): 11.1 TEMP. (F): 70.0 B.P.F. (HZ.) : 119.

LW = SOUND POWER (RE:10-12 WATTS). LP = SOUND PRESSURE (RE:0.0002 MB).

ONE STAGE AXIAL UNATTENUATED FAN NOISE LEVELS:
** LP LEVELS ARE AT 1 METER FROM THE SURFACE **

TOTAL SOUND POWER LEVELS OF THE FAN: REFERENCE ONLY.

FREQ.(HZ):	31.5	63	125	250	500	1K	2K	4K	8K	16K	TOTAL:
LW (DB):	121	123	129	130	125	124	122	118	114	107	135
LW(DBA):	82	97	113	121	122	124	123	119	113	100	129

NOISE BASED ON AN OPEN INLET AND AN DUCTED OUTLET.

NOISE LEVELS IN THE FAN INLET AIRSTREAM:

FREQ.(HZ):	31.5	63	125	250	500	1K	2K	4K	8K	16K	TOTAL:
LW (DB):	111	115	124	125	120	117	113	107	101	92	129
LW(DBA):	72	89	108	116	117	117	114	108	100	85	123
LP (DB):	96	100	109	110	105	102	98	92	86	77	114
LP(DBA):	57	74	93	101	102	102	99	93	85	70	107

NOISE LEVELS OUTSIDE THE FAN OUTLET DUCT:

FREQ.(HZ):	31.5	63	125	250	500	1K	2K	4K	8K	16K	TOTAL:
LW (DB):	111	111	113	108	102	92	82	85	73	58	118
LW(DBA):	72	85	97	99	99	92	83	86	72	51	104
LP (DB):	90	90	92	87	81	71	61	64	52	37	96
LP(DBA):	51	64	76	78	78	71	62	65	51	30	83

NOISE LEVELS FROM THE FAN CASING: LLIN.= 121.4 237.1

FREQ.(HZ):	31.5	63	125	250	500	1K	2K	4K	8K	16K	TOTAL:
LW (DB):	128	128	129	125	121	118	109	96	86	75	134
LW(DBA):	89	102	113	116	118	118	110	97	85	68	123
LP (DB):	104	104	105	101	97	94	85	72	62	51	110
LP(DBA):	65	78	89	92	94	94	86	73	61	44	99

TOTAL NOISE LEVELS IN THE FAR FIELD: DISTANCE "S" = 304.8 M. = 1000'

	DISCHARGE/STACK:	CASING:	OPEN INLET:
LP (DB):	73	82	77
LP(DBA):	63	71	71

RONE1 = 51.7 DB

TLT: .00 .00 .00 1.00 4 85 58.0

ALL NOISE LEVELS ARE FOR THE FREE FIELD CONDITION.
THE LEVELS DO NOT INCLUDE INCREASES FROM MULTIPLE FANS, REVERBERATION, OR REFLECTION.

FAN SOUND PRESSURE @1000' FROM THE FAN CAUSED by the NOISE COMING FROM the FAN CASING (HOUSING) without ANY NOISE INSULATION FOR THE FAN HOUSING.

Sheet #3.

ATTENUATION OF THE FAN Housing Noise by different Thickness of Noise insulation

INSULATION FOR THE FAN HOUSING.
MINERAL WOOL 6-8 LBS/FT3 DENSITY WITH 20 GA. GALV STEEL FOR LAGGING.
SEE STAND. BKMX01 & BKMX02. ** ADD 3 DB IF USING ALUM. LAGGING! **

NOISE LEVELS FOR THE INSULATED FAN CASING:

FREQ.(HZ):	31.5	63	125	250	500	1K	2K	4K	8K	16K	TOTAL:
2 IN. THERMAL INSULATION.											
LP (DB):	109	107	105	97	90	87	77	63	53	41	112
4 IN. THERMAL INSULATION.											
LP (DB):	108	104	101	92	84	79	68	54	43	32	110
6 IN. THERMAL INSULATION.											
LP (DB):	105	101	97	87	77	71	59	44	33	21	107
2 IN. A.I.& L.											
LP (DB):	109	107	104	96	87	80	67	53	42	31	112
4 IN. A.I.& L.											
LP (DB):	108	102	99	89	78	69	56	41	30	19	109
4 IN. A.I.& L.& 0.062 IN. OF RUBBER.											
LP (DB):	104	100	94	82	72	64	52	38	26	11	106
6 IN. A.I.& L.											
LP (DB):	105	100	95	83	74	64	52	37	27	16	107
6 IN. A.I.& L. & 0.062 IN. OF RUBBER.											
LP (DB):	104	98	91	79	69	62	50	34	24	12	105
10 IN. A.I.& L.											
LP (DB):	104	99	92	81	71	64	52	38	26	11	105
10 IN. A.I.& L.& 0.062 IN. OF RUBBER.											
LP (DB):	101	94	87	75	65	54	42	26	14	1	102

TLT-BACOCK, INC. SOUND ANALYSIS

EXHAUSTING FAN

Sheet #1A

TLT-BABCOCK, INC. SOUND ANALYSIS: VER. 1.9S, 8/95

JOB NO:03-00251-M CUST:Energy West Mining FAN SIZE:GA 25/12.6-1
FLOW (ACFM): 454000.0 DENSITY (LB/FT3):.0590 SPEED (R.P.M.):1185.
PRES.(INWG): 11.1 TEMP. (F): 70.0 B.P.F. (HZ.) : 119.

LW = SOUND POWER (RE:10-12 WATTS). LP = SOUND PRESSURE (RE:0.0002 MB).

ONE STAGE AXIAL UNATTENUATED FAN NOISE LEVELS:
** LP LEVELS ARE AT 1 METER FROM THE SURFACE **

TOTAL SOUND POWER LEVELS OF THE FAN: REFERENCE ONLY.

FREQ.(HZ):	31.5	63	125	250	500	1K	2K	4K	8K	16K	TOTAL:
LW (DB):	121	123	129	130	125	124	122	118	114	107	135
LW(DBA):	82	97	113	121	122	124	123	119	113	100	129

NOISE BASED ON AN DUCTED INLET AND AN OPEN OUTLET. → Exhaust FAN

NOISE LEVELS OUTSIDE THE FAN INLET DUCT:

FREQ.(HZ):	31.5	63	125	250	500	1K	2K	4K	8K	16K	TOTAL:
LW (DB):	110	110	112	107	101	91	81	84	72	57	117
LW(DBA):	71	84	96	98	98	91	82	85	71	50	103
LP (DB):	89	89	91	86	80	70	60	63	51	36	95
LP(DBA):	50	63	75	77	77	70	61	64	50	29	82

NOISE LEVELS IN THE FAN OUTLET AIRSTREAM:

FREQ.(HZ):	31.5	63	125	250	500	1K	2K	4K	8K	16K	TOTAL:
LW (DB):	112	116	125	126	121	118	114	108	102	93	130
LW(DBA):	73	90	109	117	118	118	115	109	101	86	124
LP (DB):	96	100	109	110	105	102	98	92	86	77	114
LP(DBA):	57	74	93	101	102	102	99	93	85	70	107

NOISE LEVELS FROM THE FAN CASING: LLIN.= 121.4 237.1

FREQ.(HZ):	31.5	63	125	250	500	1K	2K	4K	8K	16K	TOTAL:
LW (DB):	128	128	129	125	121	118	109	96	86	75	134
LW(DBA):	89	102	113	116	118	118	110	97	85	68	123
LP (DB):	104	104	105	101	97	94	85	72	62	51	110
LP(DBA):	65	78	89	92	94	94	86	73	61	44	99

TOTAL NOISE LEVELS IN THE FAR FIELD: DISTANCE "S" = 152.4 M. = 500'

	DISCHARGE/STACK:	CASING:	OPEN INLET:
LP (DB):	79	88	83
LP(DBA):	70	77	77

RONE1 = 45.7 DB

TLT: .00 .00 .00 1.00 4 85 51.8

ALL NOISE LEVELS ARE FOR THE FREE FIELD CONDITION.
THE LEVELS DO NOT INCLUDE INCREASES FROM MULTIPLE FANS, REVERBERATION, OR REFLECTION.

FAN SOUND PRESSURE @ 500' FROM FAN CAUSED by The NOISE Coming FROM The FAN CASING (housing)

Exhaust FAN ARRANGEMENT

Sheet #2A

TLT-BABCOCK, INC. SOUND ANALYSIS: VER. 1.9S, 8/95

JOB NO:03-00251-M CUST:Energy West Mining FAN SIZE:GA 25/12.6-1
FLOW (ACFM): 454000.0 DENSITY (LB/FT3):.0590 SPEED (R.P.M.):1185.
PRES.(INWG): 11.1 TEMP. (F): 70.0 B.P.F. (HZ.) : 119.

LW = SOUND POWER (RE:10-12 WATTS). LP = SOUND PRESSURE (RE:0.0002 MB).

ONE STAGE AXIAL UNATTENUATED FAN NOISE LEVELS:
** LP LEVELS ARE AT 1 METER FROM THE SURFACE **

TOTAL SOUND POWER LEVELS OF THE FAN: REFERENCE ONLY.

FREQ.(HZ):	31.5	63	125	250	500	1K	2K	4K	8K	16K	TOTAL:
LW (DB):	121	123	129	130	125	124	122	118	114	107	135
LW(DBA):	82	97	113	121	122	124	123	119	113	100	129

NOISE BASED ON AN DUCTED INLET AND AN OPEN OUTLET. → Exhaust FAN

NOISE LEVELS OUTSIDE THE FAN INLET DUCT:

FREQ.(HZ):	31.5	63	125	250	500	1K	2K	4K	8K	16K	TOTAL:
LW (DB):	110	110	112	107	101	91	81	84	72	57	117
LW(DBA):	71	84	96	98	98	91	82	85	71	50	103
LP (DB):	89	89	91	86	80	70	60	63	51	36	95
LP(DBA):	50	63	75	77	77	70	61	64	50	29	82

NOISE LEVELS IN THE FAN OUTLET AIRSTREAM:

FREQ.(HZ):	31.5	63	125	250	500	1K	2K	4K	8K	16K	TOTAL:
LW (DB):	112	116	125	126	121	118	114	108	102	93	130
LW(DBA):	73	90	109	117	118	118	115	109	101	86	124
LP (DB):	96	100	109	110	105	102	98	92	86	77	114
LP(DBA):	57	74	93	101	102	102	99	93	85	70	107

NOISE LEVELS FROM THE FAN CASING: LLIN.= 121.4 237.1

FREQ.(HZ):	31.5	63	125	250	500	1K	2K	4K	8K	16K	TOTAL:
LW (DB):	128	128	129	125	121	118	109	96	86	75	134
LW(DBA):	89	102	113	116	118	118	110	97	85	68	123
LP (DB):	104	104	105	101	97	94	85	72	62	51	110
LP(DBA):	65	78	89	92	94	94	86	73	61	44	99

TOTAL NOISE LEVELS IN THE FAR ~~FIELD~~: DISTANCE "S" = 304.8 M. — =1000'

	DISCHARGE/STACK:	CASING:	OPEN INLET:
LP (DB):	73	82	77
LP(DBA):	63	71	71

RONE1 = 51.7 DB

TLT: .00 .00 .00 1.00 4 85 58.0

ALL NOISE LEVELS ARE FOR THE FREE FIELD CONDITION.
THE LEVELS DO NOT INCLUDE INCREASES FROM MULTIPLE FANS, REVERBERATION, OR REFLECTION.

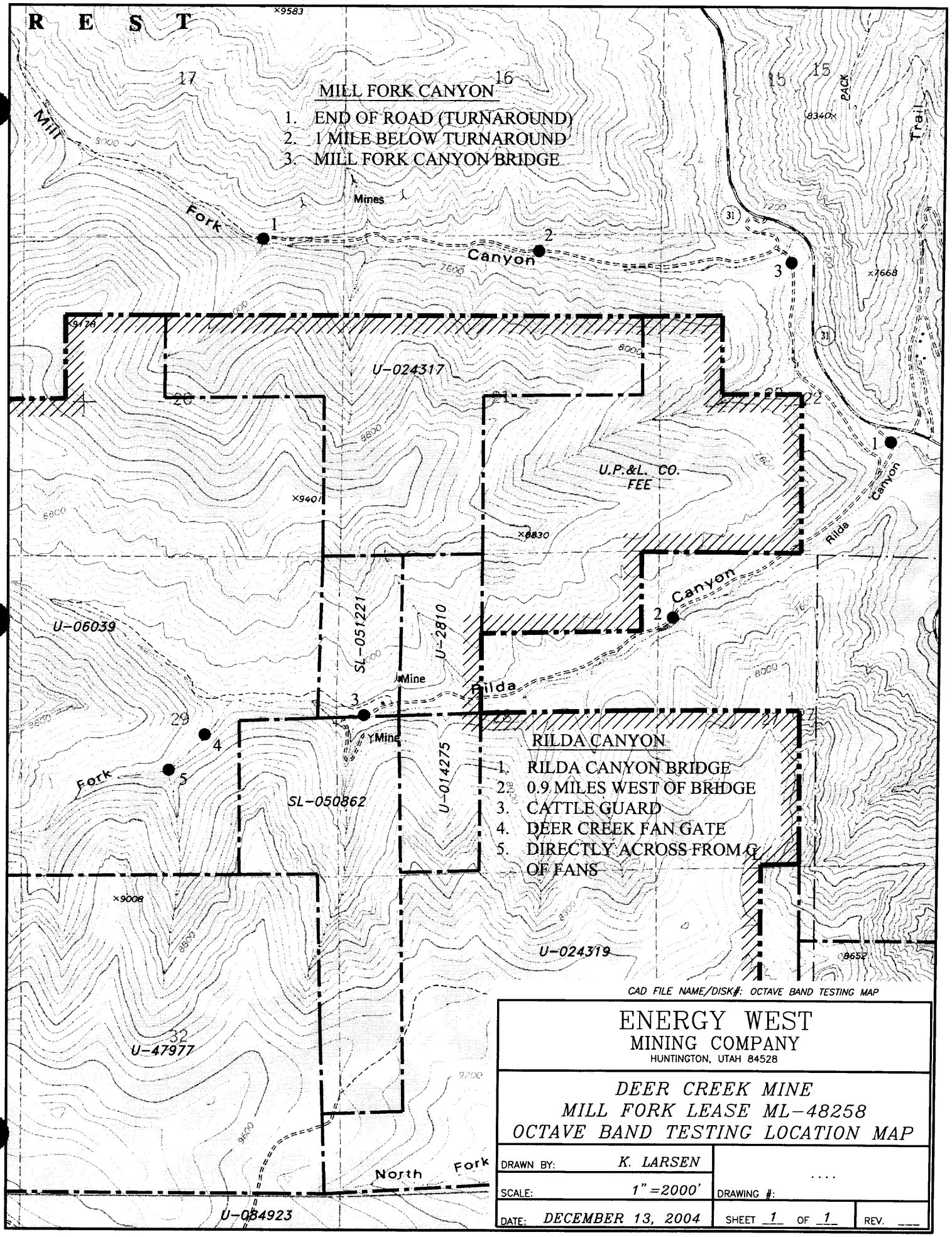
FAN SOUND PRESSURE @1000' FROM FAN CAUSED by the Noise coming from the Fan CASING (housing)
Exhaust FAN ARRANGEMENT.

INSULATION FOR THE FAN HOUSING.
MINERAL WOOL 6-8 LBS/FT3 DENSITY WITH 20 GA. GALV STEEL FOR LAGGING.
SEE STAND. BKMX01 & BKMX02. ** ADD 3 DB IF USING ALUM. LAGGING! **

NOISE LEVELS FOR THE INSULATED FAN CASING:

FREQ.(HZ):	31.5	63	125	250	500	1K	2K	4K	8K	16K	TOTAL:
2 IN. THERMAL INSULATION.											
LP (DB):	109	107	105	97	90	87	77	63	53	41	112
4 IN. THERMAL INSULATION.											
LP (DB):	108	104	101	92	84	79	68	54	43	32	110
6 IN. THERMAL INSULATION.											
LP (DB):	105	101	97	87	77	71	59	44	33	21	107
2 IN. A.I.& L.											
LP (DB):	109	107	104	96	87	80	67	53	42	31	112
4 IN. A.I.& L.											
LP (DB):	108	102	99	89	78	69	56	41	30	19	109
4 IN. A.I.& L.& 0.062 IN. OF RUBBER.											
LP (DB):	104	100	94	82	72	64	52	38	26	11	106
6 IN. A.I.& L.											
LP (DB):	105	100	95	83	74	64	52	37	27	16	107
6 IN. A.I.& L. & 0.062 IN. OF RUBBER.											
LP (DB):	104	98	91	79	69	62	50	34	24	12	105
10 IN. A.I.& L.											
LP (DB):	104	99	92	81	71	64	52	38	26	11	105
10 IN. A.I.& L.& 0.062 IN. OF RUBBER.											
LP (DB):	101	94	87	75	65	54	42	26	14	1	102

OCTAVE BAND TESTING LOCATION MAP



CAD FILE NAME/DISK#: OCTAVE BAND TESTING MAP

ENERGY WEST
MINING COMPANY
HUNTINGTON, UTAH 84528

DEER CREEK MINE
MILL FORK LEASE ML-48258
OCTAVE BAND TESTING LOCATION MAP

DRAWN BY:	K. LARSEN	....	
SCALE:	1" =2000'	DRAWING #:	
DATE:	DECEMBER 13, 2004	SHEET 1 OF 1	REV. ___

MILL FORK CANYON OCTAVE BAND ANALYSIS

TIME @1415

OCTAVE BAND ANALYSIS CHART

DATE 11-22-04/11-23-04

ANALYZER & S/N MODEL 2900/CE00B0003

CALIBRATED 11-22-04 @ 114dB/11-23-04

BY CHUCK SEMPORSKI/KEN FLECK

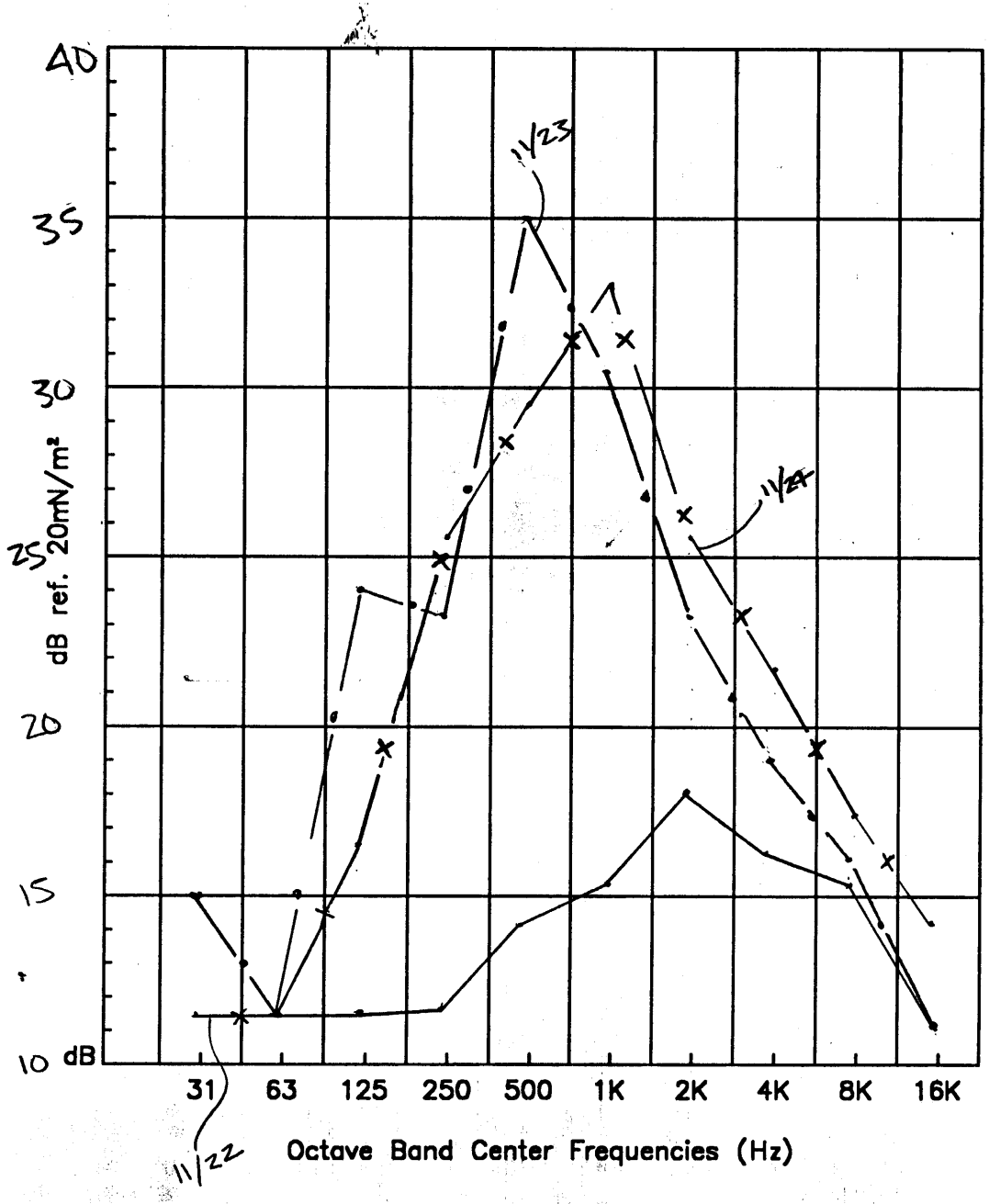
PROJECT/COMMENTS MILL FORK END OF ROAD

WEATHER 36° PC WIND < 5 MPH 11/22/04

Wind ≈ 5mph (Varies) PC T= 31° 11/23/04

11/24/04 Calm to 5+mph T=31°

TEST	#1	#2	#3
dBA	@1415	11:12	11:57
dB LIN	23.6	35.0	37.5
31 Hz	11.6	15.0	11.6
63	11.6	11.6	11.6
125	11.6	24.0	16.8
250	11.8	23.5	25.5
500	14.1	35.0	29.5
1K	15.4	30.6	33.0
2K	18.0	23.3	25.3
4K	16.6	18.5	22.0
8K	15.3	16.4	17.5
16K	11.6	11.6	14.0
	25.5	42.0	58.0



QUEST TECHNOLOGIES
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Telephone (414) 567-9157 – Toll Free (800) 245-0779
FAX (414) 567-4047

59-99
10-93

OCTAVE BAND ANALYSIS CHART

TIME 1400

DATE 11/22/04 / 11-23-04

ANALYZER & S/N MODEL 2900/LE008000003

CALIBRATED 11-22-04 @ 114 dB / 11-23-04

BY CHUCK SEMBORSKI / KEN FLECK

PROJECT/COMMENTS 1 MILE BELOW TURNAROUND

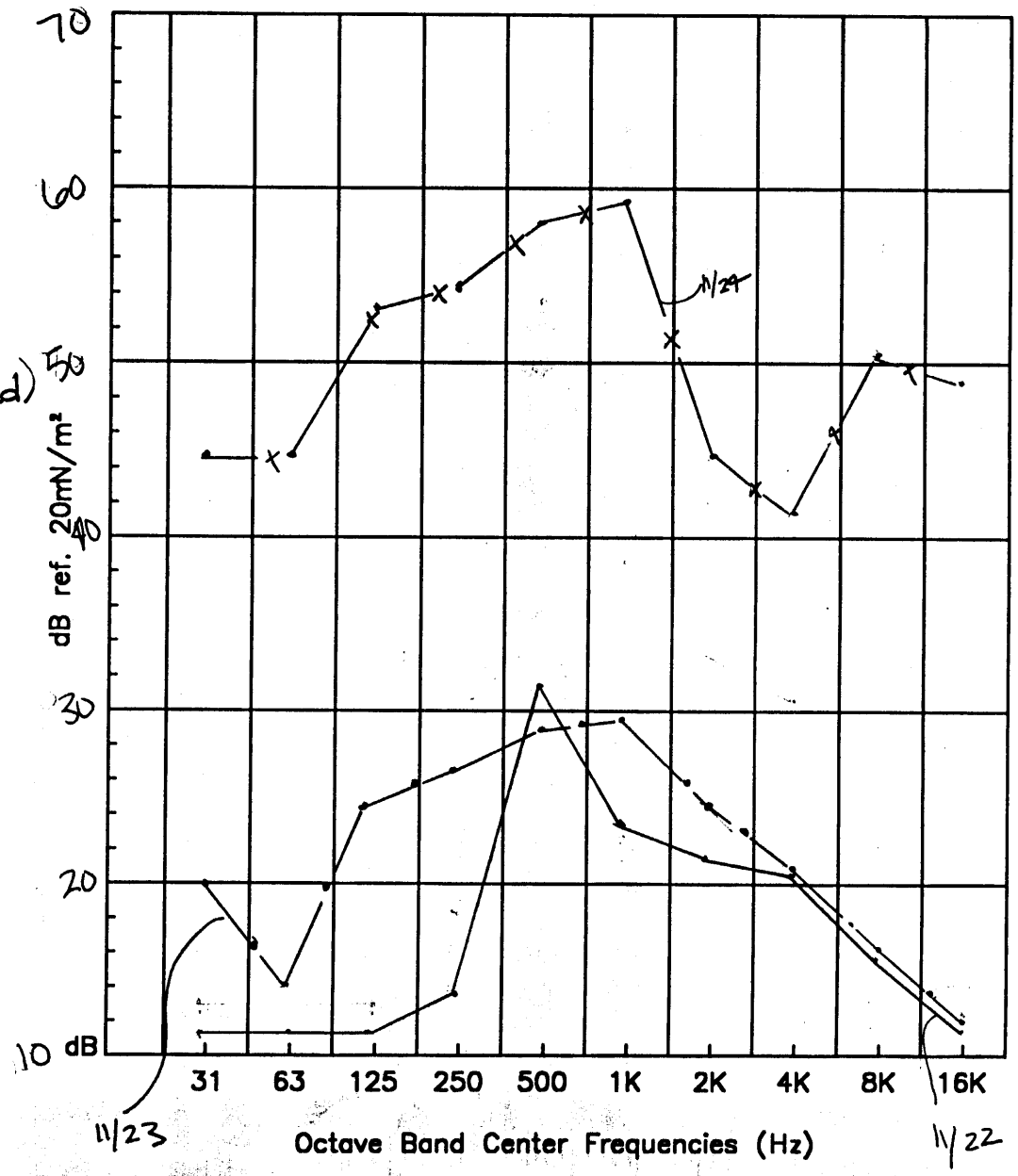
MILL FORK CANYON - V. SLIGHT BREEZE 37°

WEATHER 36° PC WINDS < 5 MPH 11-22-04

11/23/04 T = 31° PC Wind ≈ 5mph (Jet overhead)

11/24/04 Slight Breeze to 10mph T = 32° (Jet)

TEST	#1 JET IN DISTANCE	#2	#3
dBA	14:40	11:20	12:05
dB LIN	30.9	46.0	48.0
31 Hz	11.6	20.0	44.5
63	11.6	14.5	44.5
125	11.6	25.0	54.0
250	14.3	27.5	55.5
500	32.1	29.0	58.0
1K	24.2	29.5	59.5
2K	22.4	28.0	45.0
4K	20.5	21.0	42.0
8K	16.2	16.6	50.5
16K	11.6	12.0	48.5
	27.1	40.0	56.0



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OCTAVE BAND ANALYSIS CHART

TIME @ 1447

DATE 11/22/04 / 11-23-04

ANALYZER & S/N MODEL 2900/CE0080003

CALIBRATED 11-22-04 @ 114 dB/11-23-04

BY CHUCK SEMBORSKI/KEN FLECK

PROJECT/COMMENTS MILL FORK BRIDGE - 380

CAN HEAR RIVER UNDER BRIDGE, SOME

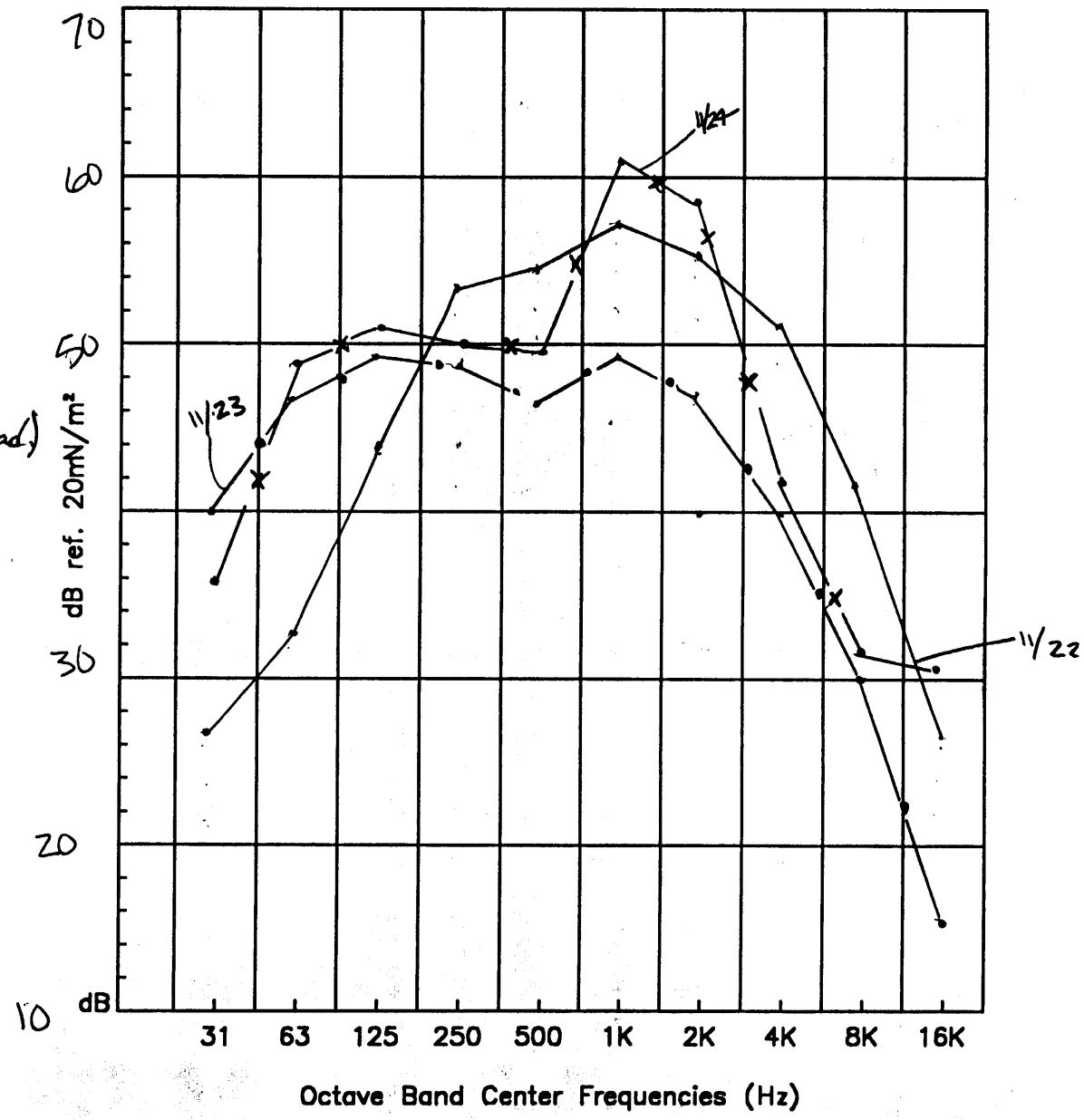
TRAFFIC ON ROAD 200' AWAY - TRUCK TRAFFIC

PEAKS @ 70 dB

T = 35° Slight Breeze (Vehicle traffic on road)

11/24/04 Breezy 5-10mph (" " ")

TEST	#1	#2	#3
dBA	14:47	11:27	12:12
dB LIN	62.2	53.0	55.5
31 Hz	26.9	40.0	36.0
63	33.1	47.0	48.5
125	45.7	49.4	51.5
250	45.1	48.0	50.0
500	54.4	46.0	49.5
1K	57.5	49.5	61.5 (coal truck)
2K	55.5	46.8	58.0
4K	50.8	40.0	42.5
8K	42.4	30.0	32.5
16K	26.3	15.0	30.5
	61.6	55.0	56.0



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RILDA CANYON OCTAVE BAND ANALYSIS

OCTAVE BAND ANALYSIS CHART

TIME@14:56

DATE 11/22/04 / 11-23-04

ANALYZER & S/N MODEL 2900/CE0080003

CALIBRATED 11-22-04 @ 114 dB / 11-23-04

BY CHUCK SEMBORSKI / KEN FLECK

PROJECT/COMMENTS RILDA CANYON BRIDGE

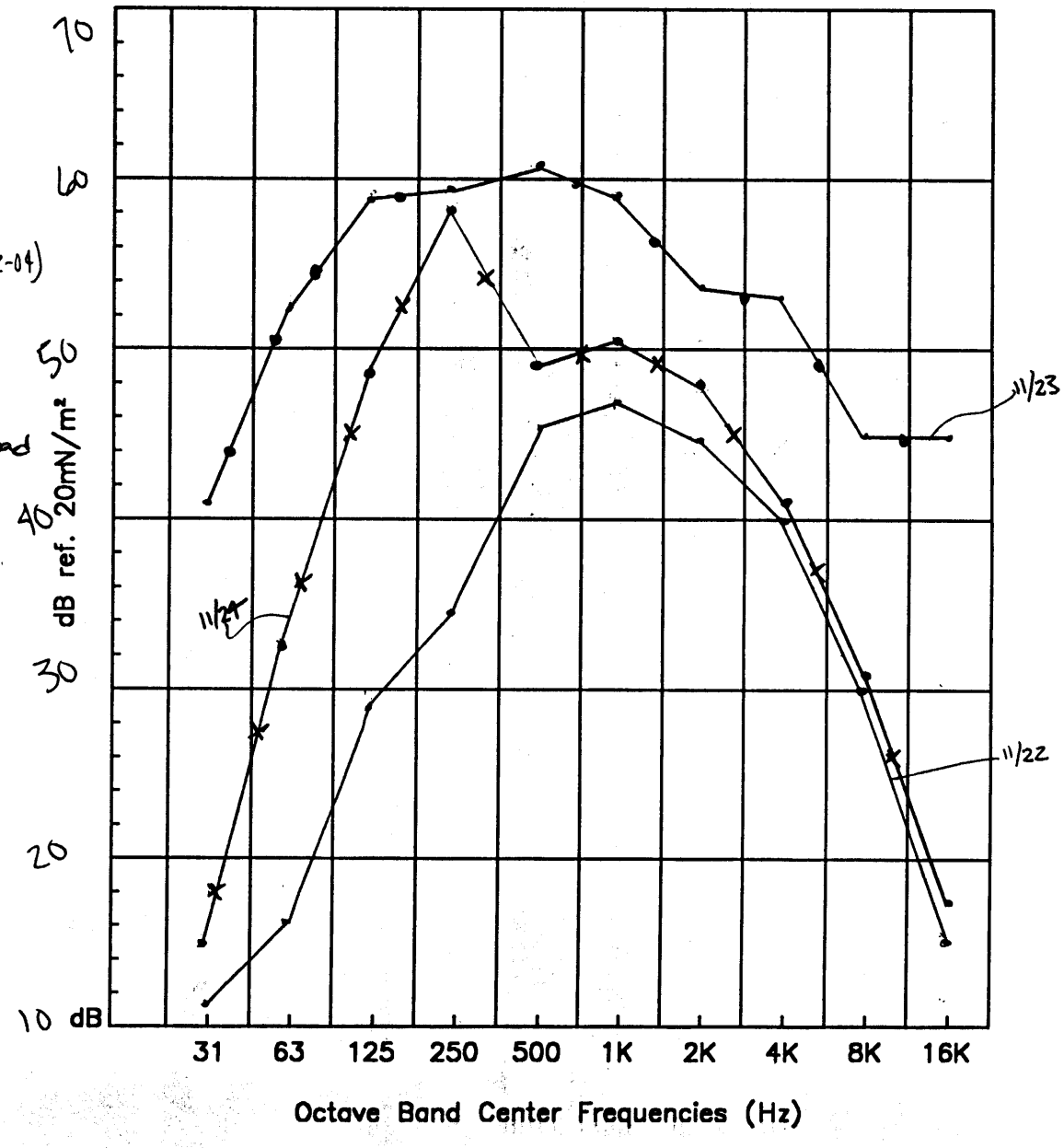
CAN NEAR RIVER UNDER BRIDGE, DOG BARKING (11-22-04)

IN DISTANCE TEMP 38°

Wind Speed 5-10mph 11/23/04

11/24/04 Slight Breeze T = 32° Traffic on road

TEST	#1	#2	#3
dBA	14:56	11:00	11:46
dB LIN	52.2	64.5	56.0
31 Hz	11.6	41.1	15.3
63	16.0	53.7	33.5
125	28.5	59.0	48.5
250	35.6	59.5	58.5
500	46.1	61.0	49.0
1K	47.7	59.2	50.5
2K	45.6	54.2	42.8
4K	40.0	53.8	41.1
8K	30.0	45.0	30.5
16K	14.9	45.0	16.5
	62.0	57.5	62.5



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10-93

OCTAVE BAND ANALYSIS CHART

TIME @ 1503

DATE 11-22-04 / 11-23-04

ANALYZER & S/N MODEL 2900/CE0080003

CALIBRATED 11-22-04 @ 114 dB 11-23-04

BY CHUCK SEMBORSKI / KEN FLECK

PROJECT/COMMENTS RILDA CANYON -

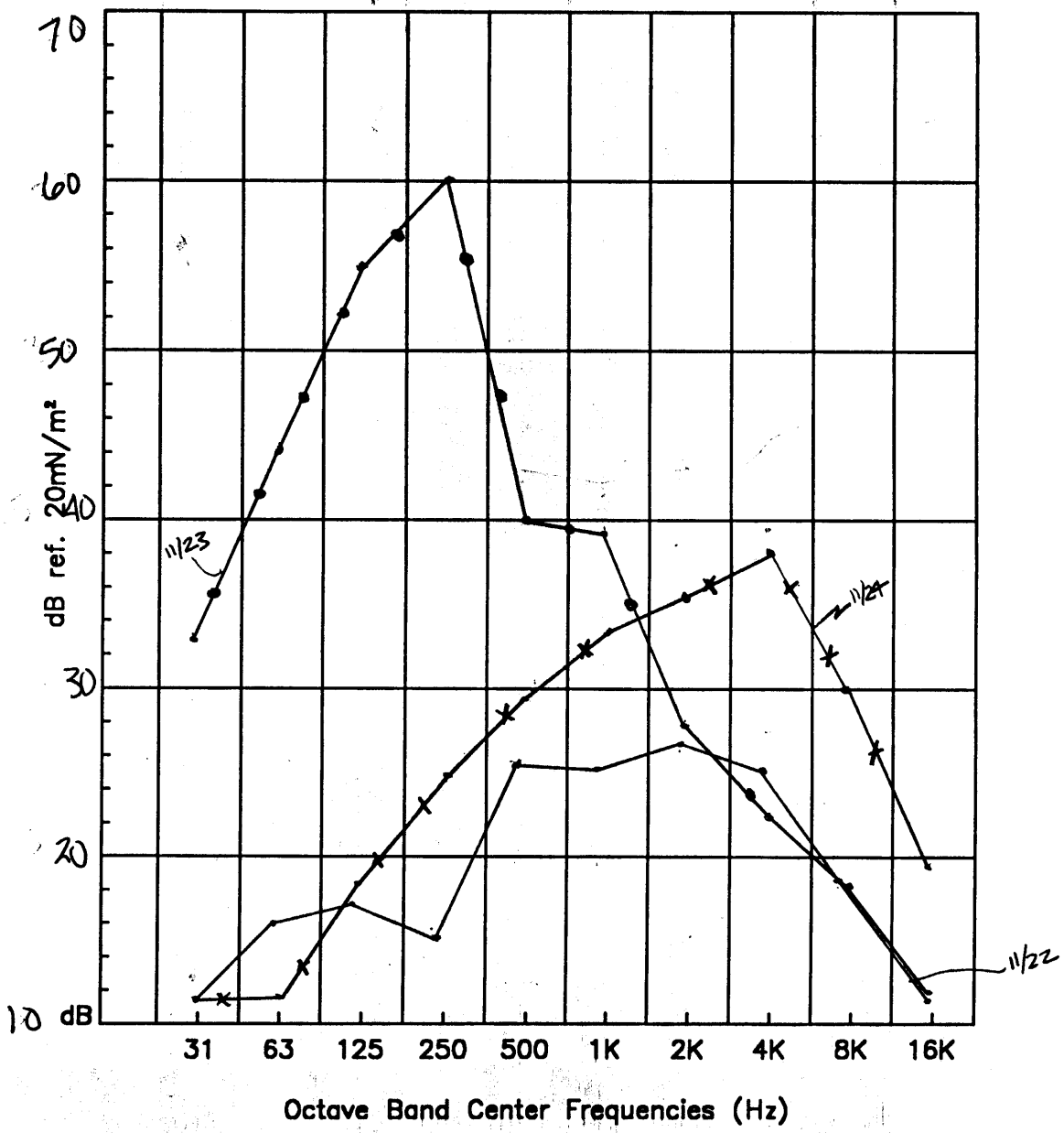
0.9 MILES WEST OF BRIDGE 390 11-22-04

Wind
x 5mph 11/23/04

11/24/04 Slight Breeze T = 31°

Can hear stream, jet, & chipmunk

TEST	#1	#2	#3
dBA	15:03	10:52	11:36
dB LIN	32.3	55.0	40.5
31 Hz	11.6	33.0	11.6
63	16.1	44.4	11.6
125	17.7	55.5	18.2
250	15.3	60.0	25.5
500	26.3	40.0	29.2
1K	26.0	39.0	34.7
2K	27.0	27.5	36.4
4K	24.8	23.2	38.0
8K	18.5	18.0	30.0
16K	11.8	12.2	19.5
	31.2	59.2	40.5



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OCTAVE BAND ANALYSIS CHART

TIME @ 15:09

DATE 11/22/04 / 11-23-04

ANALYZER & S/N MODEL 2900 / CE0080003

CALIBRATED 11-22-04 @ 114 dB 11-23-04

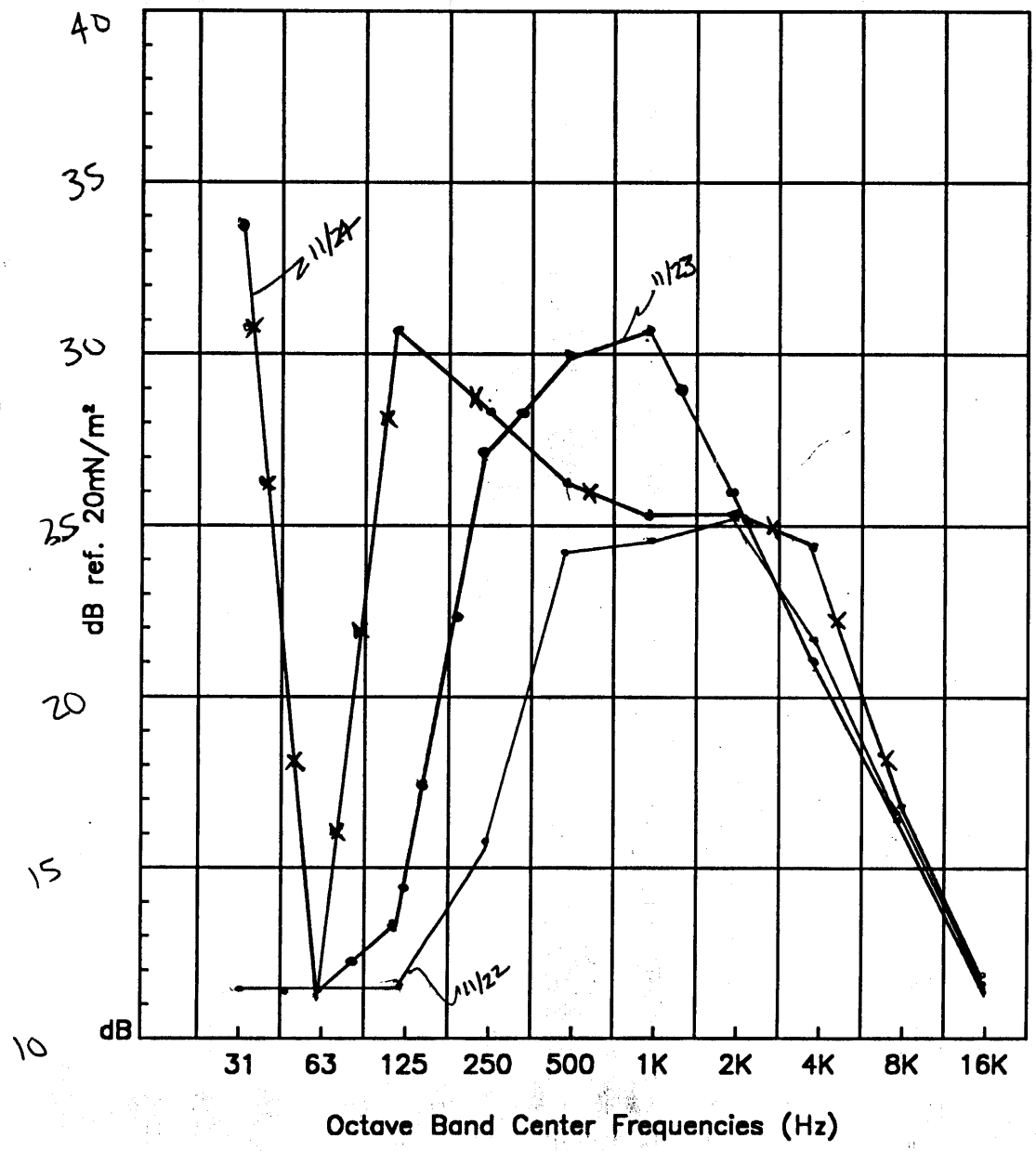
BY CHUCK SEMBORSKI / KEN FLECK

PROJECT/COMMENTS RILDA CANYON.

CATTLE GUARD 11/22 (39') CAN HEAR STREAM

11-24-03 Slight Breeze. T = 31°

TEST	#1	#2	#3
dBA	15:09	10:45	11:29
dB LIN	30.2	50.0	34.0
31 Hz	11.6	11.6	34.0
63	11.6	11.6	11.6
125	11.6	13.2	31.0
250	16.0	27.3	28.0
500	24.2	30.0	26.3
1K	24.4	31.0	25.3
2K	25.1	26.0	25.3
4K	22.1	21.5	24.5
8K	17.2	17.0	17.5
16K	11.7	11.6	11.8
	31.2	46.0	33.0



QUEST TECHNOLOGIES
1060 Corporate Center Drive, Oconomowoc, WI 53066-4828
Telephone (414) 567-9157 – Toll Free (800) 245-0779
FAX (414) 567-4047

OCTAVE BAND ANALYSIS CHART

TIME @ 15:15

DATE 11/22/04 / 11-23-04

ANALYZER & S/N MODEL 2900 / CE0080003

CALIBRATED 11-22-04 @ 114 dB 11-23-04

BY CHUCK SEMBORSKI / KEN FLECK

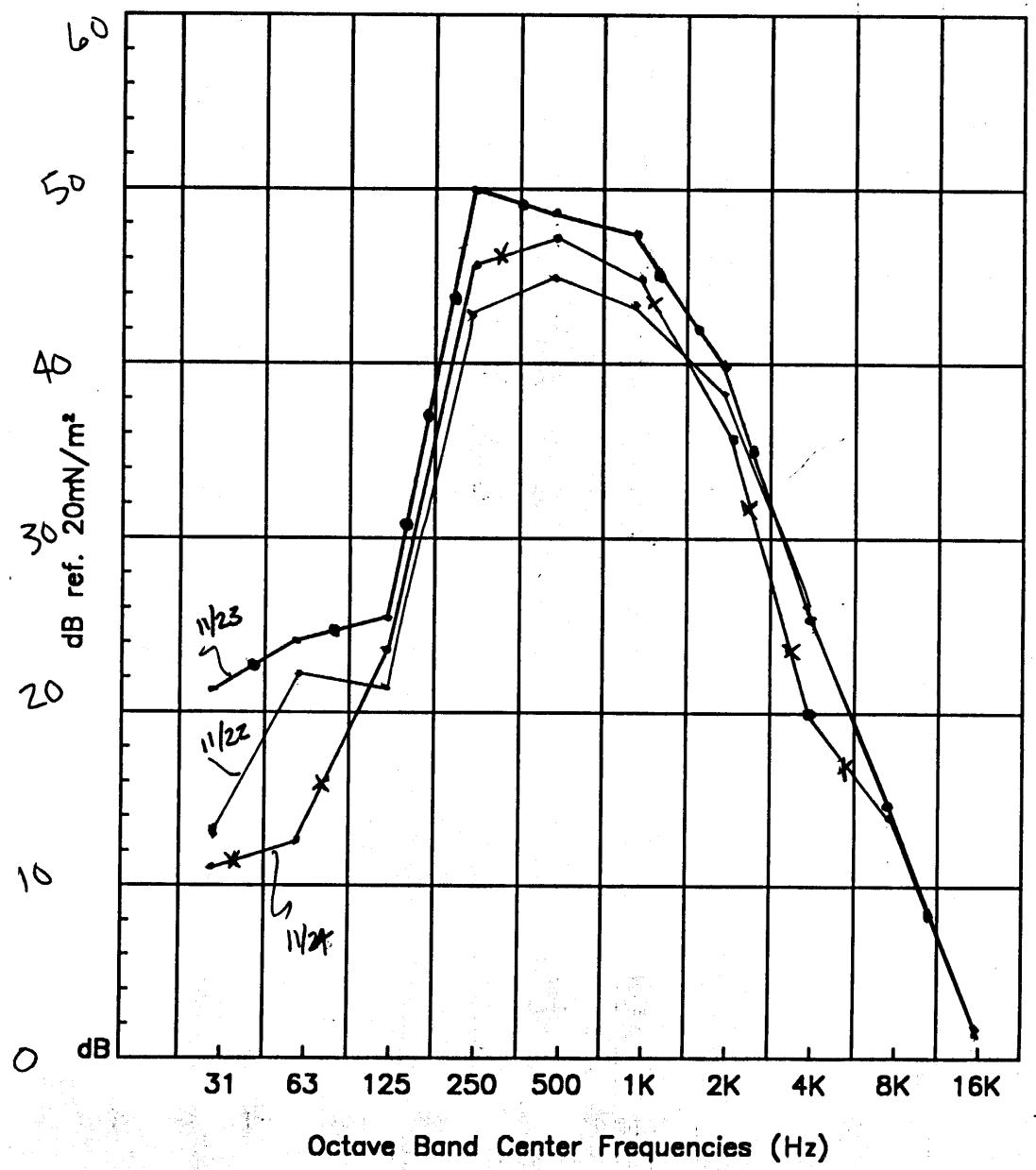
PROJECT/COMMENTS RILDA CANYON

DEER CREEK FAN GATE 39°

11-22-04 SLIGHT BREEZE

11-24-04 Calm T=29°

TEST	#1	#2	#3
dBA	15:15	10:40	11:09
dB LIN	50.2	53.0	50.9
31 Hz	12.8	21.7	11.6
63	22.0	24.4	12.8
125	21.2	25.5	22.0
250	43.0	50.0	46.4
500	45.1	48.6	47.5
1K	44.5	47.4	46.8
2K	38.8	40.0	36.6
4K	27.5	26.0	20.0
8K	16.2	16.2	15.4
16K	11.6	12.0	11.6
	50.2	56.0	50.4



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Telephone (414) 567-9157 – Toll Free (800) 245-0779
FAX (414) 567-4047

OCTAVE BAND ANALYSIS CHART

TIME @ 1525

DATE 11/22/04 / 11-23-04

ANALYZER & S/N MODEL 2900/CE0080003

CALIBRATED 11-22-04 @114 dB 11-23-04

BY CHUCK SEMBORSKI / KEN FLECK

PROJECT/COMMENTS RILDA CANYON

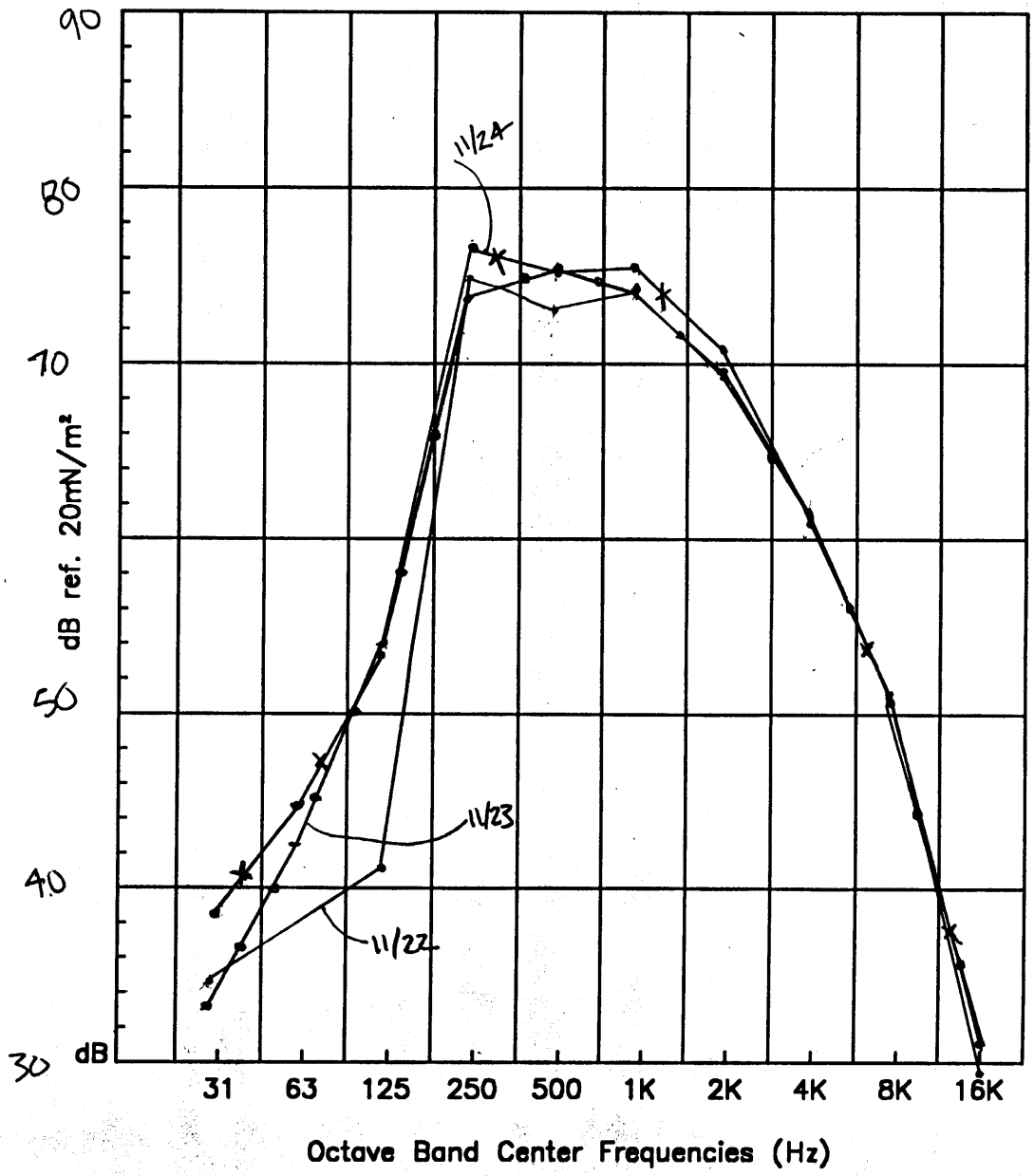
ON ROAD, DIR. ACROSS FROM ¢ FANS

11-22-04 VERY SLIGHT BREEZE

11-23-04 VERY SLIGHT BREEZE

11-24-04 calm T= 29°

TEST	#1	#2	#3
dBA	15:25	10:32	10:58
dB LIN	80.4	80.9	82.5
31 Hz	34.5	33.8	38.5
63	41.5	43.3	45.0
125	53.0	54.5	54.0
250	75.5	73.8	77.1
500	73.5	76.6	76.0
1K	74.0	74.5	75.4
2K	69.8	69.7	71.2
4K	61.7	60.9	61.4
8K	50.7	50.2	50.4
16K	29.7	31.9	31.6
	79.6	81.4	81.9

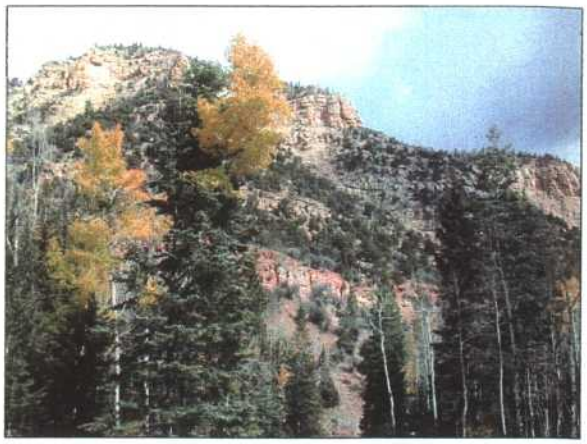


QUEST TECHNOLOGIES
1060 Corporate Center Drive, Oconomowoc, WI 53066-4828
Telephone (414) 567-9157 – Toll Free (800) 245-0779
FAX (414) 567-4047

R645-301-300 BIOLOGY SECTION

APPENDIX F
MSO HABITAT REPORT

♦ **Habitat Suitability Determination Report, 10/5/04, EIS Environmental & Engineering Consulting**



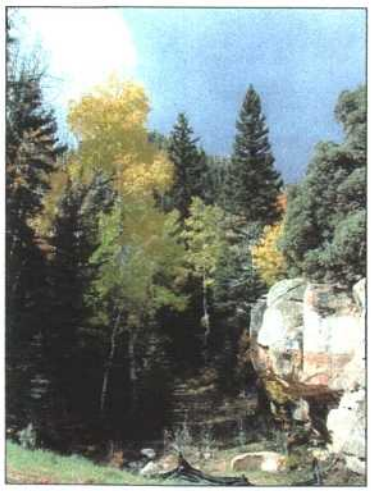
Energy West Mining Company
Rilda Canyon
Emery County, Utah

(*Strix occidentalis lucida*)
Mexican Spotted Owl

Habitat Suitability Determination Report

Conducted
October 5, 2004

By:
EIS Environmental
& Engineering Consulting
31 North Main Street
Helper, Utah 84526
(435) 472-3814
Fax - (435) 472-8780
www.eisenviro.com
eisec@preciscom.net



Rilda Canyon
Mexican Spotted Owl
(*Strix occidentalis lucida*)

Habitat Suitability
Determination Report

1.0 Introduction:

On October 5, 2004, Mr. M.A. Coonrod of EIS Environmental & Engineering Consulting conducted a habitat suitability survey for the Mexican spotted owl (MSO) in Rilda Canyon, Emery County, Utah (see Plate I). The U.S. Fish and Wildlife Service (USFWS) using a habitat suitability model developed in 1997 and 2000, has described the area in question as containing habitat or potential habitat for the MSO. The survey was conducted in order to determine if the area exhibited characteristics that would deem it suitable nesting and foraging habitat for the MSO.

2.0 Mexican Spotted Owl Habitat Requirements:

The Mexican spotted owl (MSO) is found in a variety of habitats ranging from southern British Columbia to central Mexico. Specifically, in Utah they are primarily found in deeply entrenched canyons that have numerous cliffs and ledges, located mostly on the Colorado Plateau. The spotted owl occupies a variety of habitats in different parts of its range, including various forest types and steep rocky canyons, this last habitat being the primary habitat used in Utah. This species will nest in stick nest built by other birds, on debris platforms in trees, in tree cavities, or on cliff ledges. Spotted owls feed mainly on rodents (wood rats) but also consume rabbits and some other vertebrates, including birds and reptiles, and insects. Little is known about the habitat range of foraging owls except that they forage a wider range of habitats than they utilize for roosting.

The Federal Register, 50 CFR Part 17 describes three levels of habitat management for this species: protected areas, restricted areas, and other forest and woodland types.

- **Protected Habitat :** Protected areas are those that are within mixed conifer or pine-oak types with slopes greater than 40 percent, and where timber harvest has not occurred in the last 20 years. Mixed conifer forests are those generally comprised of Douglas fir, white fir, ponderosa pine, and/ or quaking aspen. Another protected habitat is described as canyon habitat. This habitat is described as deep, narrow, rocky, mesic canyons with slopes greater than 40 Percent. Both mixed conifer and canyon habitat areas are preferred by the owls for nesting, roosting, and foraging.

- **Restricted Habitat:** Restricted habitats are those that include mixed conifer, pine-oak forest, and riparian areas outside of protected areas. Pine-oak forests as they pertain to the MSO are those that contain any Chihuahua pine and those forests that have ponderosa pine and Gambel oak. These areas are identified with the recovery plan as areas needed for future growth of the species.

- **Forest and Woodland:** The last habitat management type is other forest and woodlands. These include those consisting predominantly of ponderosa pine, spruce-fir, pinyon-juniper, and aspen. Though these habitats do not contain occupied nesting or roosting habitat, they do provide possible foraging habitat.

A Memorandum from the Utah Field Supervisor of the USFWS, dated November 21, 2002 states that:

1. "The 1997 model should be used as a first-cut analysis tool to identify potentially rugged areas that may provide suitable owl habitats...."
2. "The 2000 model predicts the location of breeding and roosting habitat within rugged canyon habitat...."
3. "Buffers should be applied to the 2000 model, as follows, and used when evaluating potential project impacts...."
   a. A 0.5-mile radius should buffer all pixels, including isolated pixels. Habitat within this radius should be evaluated and surveyed for owls, according to protocol.
   b. "Implement the '2X2 Rule', any canyon habitat where the canyon is less than 2 km wide and at least 2 km long should be considered and managed as Protected Habitat. Canyons meeting the 2X2 rule should also be assessed for the need for owl surveys."

3.0 Methodology:

Prior to implementing the survey, the 1997 and 2000 models were overlaid in the area of Rilda Canyon (see Plate II). The model indicated that portions of the area did in fact have at least one of the required characteristics, however, the canyon was wider than 2 km.

The canyon was visited during the daylight hours of October 5, 2004. Mr. Coonrod confirmed that the area surveyed did contain many of the requirements for suitable habitat. The north facing slopes contained a semi-closed canopy of mixed conifer including ponderosa pine, alpine

fir, and Douglas fir on slopes of 30 to 80 percent. South facing canyon walls were open grass/brush communities containing mountain mahogany pinyon/juniper communities and salina wild rye. Canyon walls contained north facing rock formations with pockets and caves suitable for nesting habitat. A perennial stream traverses the canyon bottom with a mixed canopy composed of deciduous and coniferous species. Elevation in this area ranges from 7,600 in the bottom of the canyon, 9,401 feet on the south facing walls and 9,350 on the north facing walls. The ridges crest at approximately 9,400 feet in elevation. The area is characterized with cold winters averaging between two and six feet of snow and hot relatively dry summers. Photographs of the area are located in Exhibit A.

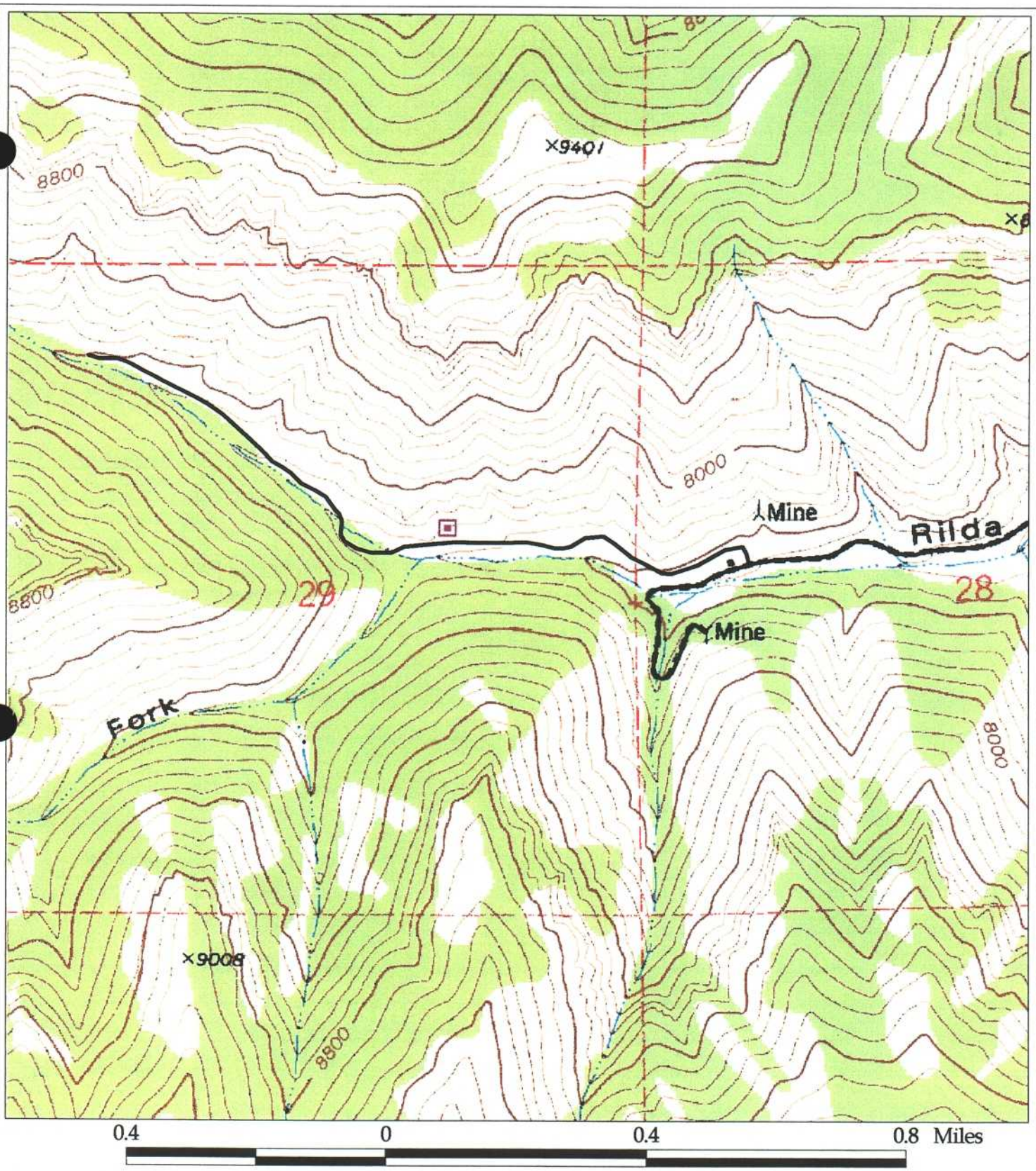
4.0 Results:

Although Rilda Canyon does contain many of the habitat constituents for the Arizona and New Mexico MSOs that could deem the area as suitable habitat, it is known that the MSOs in Utah tend to nest in lower elevations (below 8,000 feet) and in Sandstone Formations. The Manti-LaSal National Forest has conducted numerous surveys over the last four years in areas with similar habitat constituents; the oil and gas industry has also conducted surveys in several canyons with similar habitats approximately five miles north. No MSOs have been located as a result of these surveys.

A general consensus of opinion indicated the MSO nesting sites are normally located on the steeper slopes, at mid-canyon levels below 8,000 feet in elevation. The area of the proposed disturbance would approach the maximum limit in elevation where MSOs have been located. Based on the surveys completed in the same general area, with similar habitat components, and the absence of MSOs; it would be reasonable to conclude that surveys in this area are not warranted.

PLATE I

GENERAL LOCATION MAP



LEGEND

Road

Proposed Facility

N

Energy West Mining Company

PLATE I -

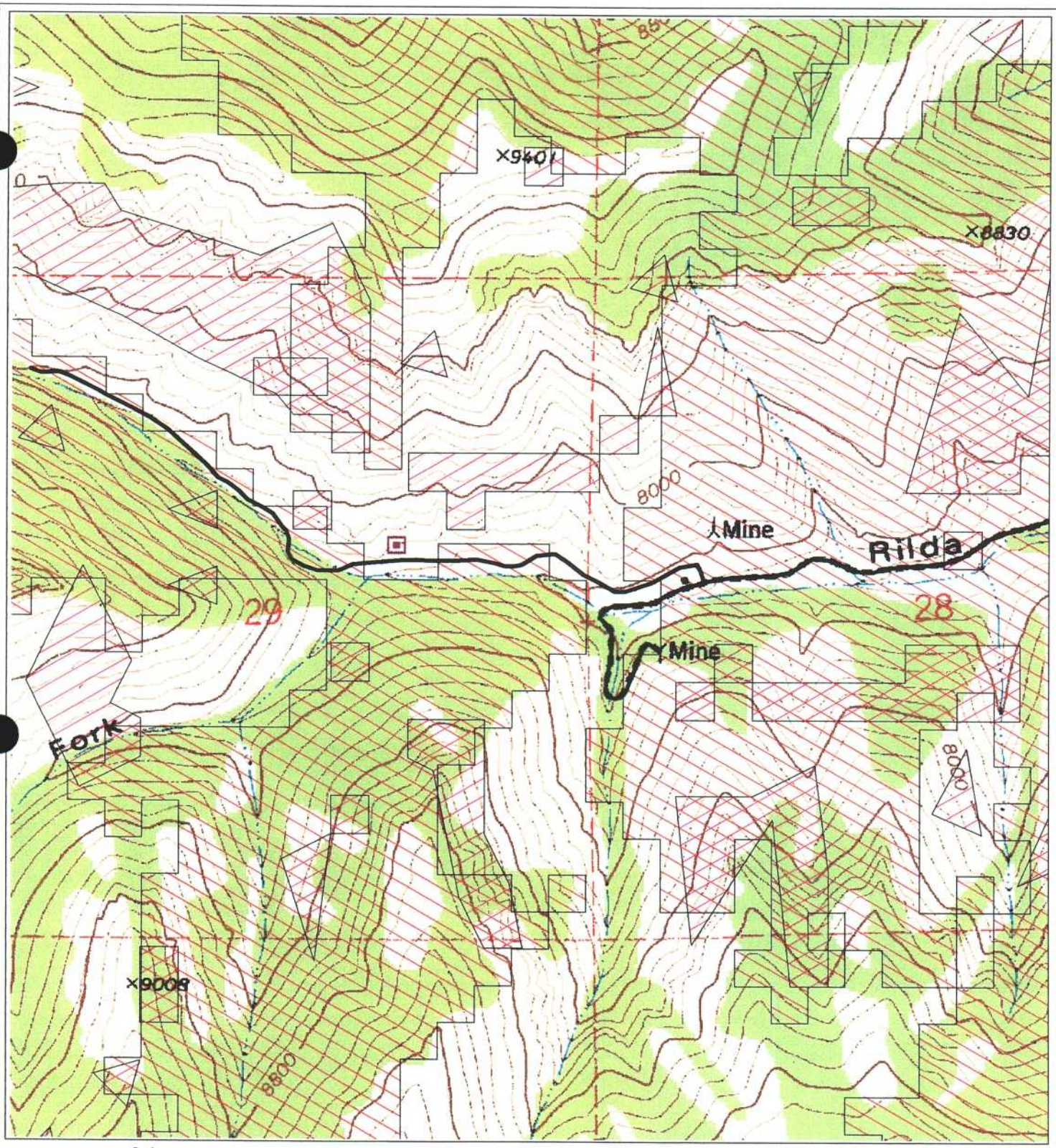
General Location Map

Drawn By: Katie J. Nash
Date: October 19, 2004

EIS Environmental &
Engineering Consulting
31 North Main Street
Helper, Utah 84526
(435) 472-3814
(800) 641-2927
Fax- (435) 472-8780
eis.gis@preciscom.net

PLATE II

GENERAL LOCATION MAP WITH 1997 AND 2000 MODELS OVERLAY



0.4 0 0.4 0.8 Miles

LEGEND

- Road
- Proposed Facility
- 2000 Model - Gap Habitat
- 2000 Model - Canyon Habitat
- 1997 Model - Prime Breeding Habitat

N

Energy West Mining Company

PLATE II -
1997 and 2000
Mexican Spotted Owl
Habitat Models

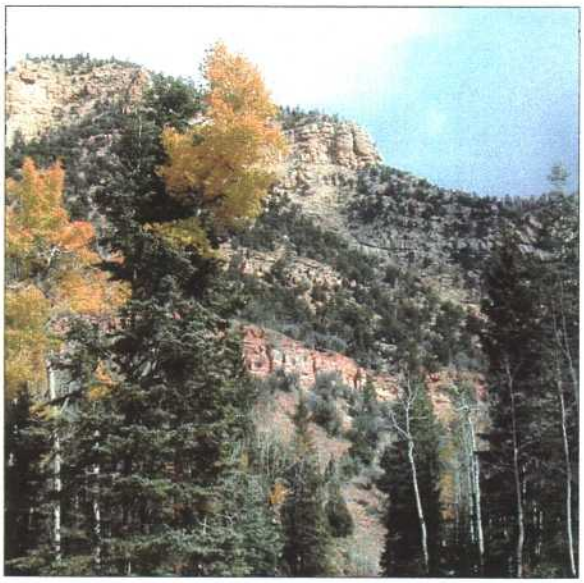
Drawn By: Katie J. Nash
Date: October 19, 2004

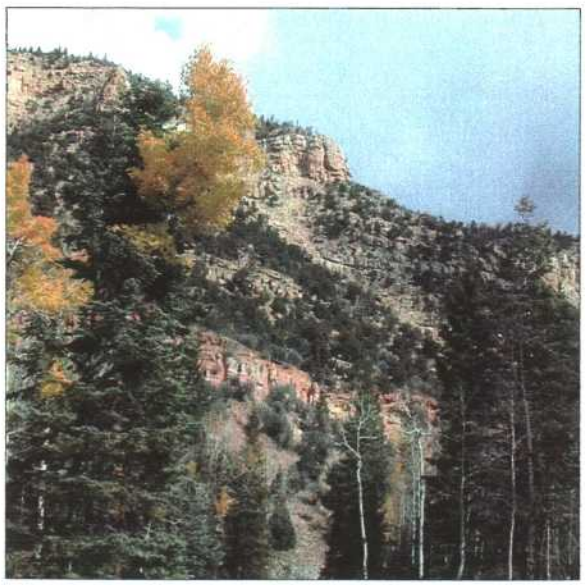
EIS Environmental &
Engineering Consulting
31 North Main Street
Helper, Utah 84526
(435) 472-3814
(800) 641-2927
Fax- (435) 472-8780
eis.gis@preciscom.net

EXHIBIT A

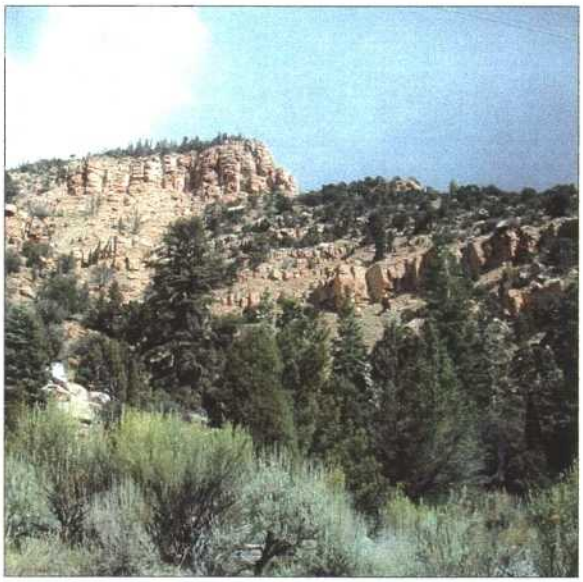
RILDA CANYON PHOTOGRAPHS

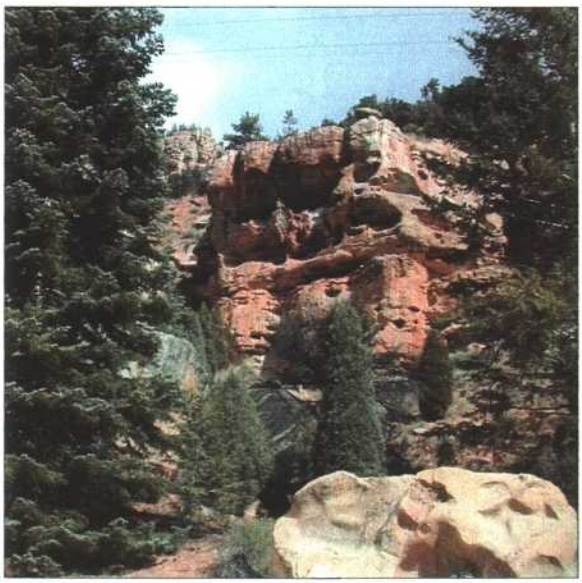
Rilda Canyon



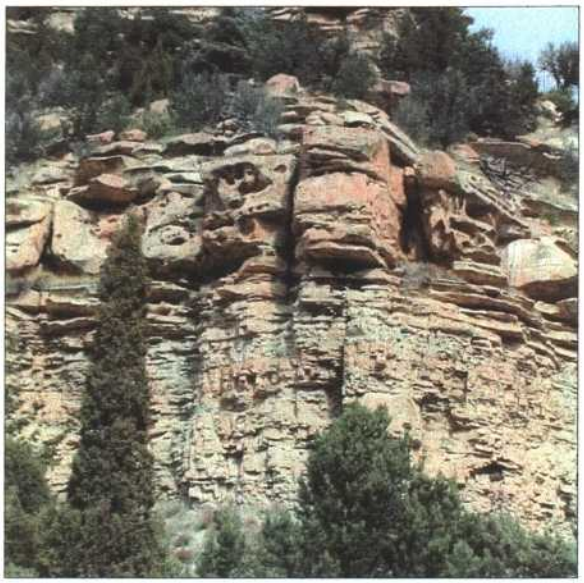


Rilda Canyon





Rilda Canyon



R645-301-300 BIOLOGY SECTION

APPENDIX G
BAT HABITAT EVALUATION

♦ **An Evaluation of Bat Habitat: Rilda Canyon, Emery County, Utah, Joel M. And Gabrielle F. Diamond, October 2004**

An Evaluation of Bat habitat: Rilda Canyon Emery County, Utah

Conducted for Energy West Mining

October 2004

Submitted by:

Joel M. Diamond

Gabrielle F. Diamond
101 South 300 East
Richmond, Ut 84333
(435)258-3617
batfreaks@hotmail.com

Introduction

Bats use habitat for a variety of purposes including feeding, mating, commuting, roosting, and hibernating (Adams 2003). Alterations to available habitat and increasing human disturbance may lead to changes in species composition within affected areas. These disturbances can affect bat habitat on the landscape or local scale either by physically altering roosting sites (trees, caverns, cliff faces and cervices) and/or changing insect food source composition (altering stream flow and eliminating open water) within the area (Campbell et al. 1998). Studies of roosting sites show bats abandoning the roost due to both tactile and non-tactile human disturbance to the roosting area (Thomas 1995). Bats use may respond to disturbances of landscape and local scaled differently. Small scale human disturbance of bat habitat such as the construction of a new work portal may only minimally affect bat foraging behavior while bat roosting behavior may be negatively affected due to their sensitivity to disturbance at the roosting site (Campbell et al. 1998).

Bat roost site locations are often located near streams or water sources (Campbell et al. 1996). It is suggested that these riparian habitats possess more prey insects and provide the water needed by bats (Campbell et al. 1996). Water sources will provide the best estimation of bats using an area as they need to obtain water and food nightly (Adams 2003). Previous work has shown that bats regularly exploit water sources that are calm rather than turbulent as they obtain water while in flight (Mackey and Barclay 1989). These results imply that bats require certain water structures for utilization due to water acquisition while on the wing. Suitable water sites are typically free from dense clutter and vegetation to allow for an aerial approach as well as relatively calm surfaces. Any perturbations of these water sites will likely negatively affect bat foraging and watering behavior. Any survey of bat habitat must take into account the presence of and structure of the water sources within the area.

The most reliable methods for accessing whether a bat population is using an area are through acoustic detection, the actual capture of resident bats and analysis of habitat evaluating potential and current bat uses (O'Farrell et al. 1999a). Acoustic detection methods are conducted using an electronic bat detector that records and displays bat calls which allows observers to

identify a bat species using echolocation calls (O'Farrell et al. 1999a). Many species have differing echolocation calls that vary with frequency and duration but the extent of this variability remains debatable. These acoustic differences are useful in identifying bat species but they must be used cautiously and with an understanding of their limitations to create a species inventory (Barclay 1999). Capture techniques are the most definitive method for accessing which species are using an area (O'Farrell et al. 1999b). Unfortunately, capture techniques alone will not create an inventory of what species are using a site due to variation in capture rates between species. Many species evade nets easily and often use habitat on a variable temporal or spatial scale (O'Farrell et al. 1999b). Acoustic and capture techniques when used alone will only give a relative measure of population abundance (Oliver 2000). When used in combination researchers gain a clearer picture of what bat species are using an area by providing direct analysis of bat use (Oliver 2000).

Assessing bat activity through a detailed survey of available and potential roosting habitat within a given area is another reliable way to detect bat use. Roosts provide not only a secure location for reproduction, rearing of young and hibernation through times of food scarcity but also migratory stopovers, foraging sites and place to rest in the day (Adams 2003). Bats use roosts to escape from climatic pressures thus information on the thermal qualities of a roost aide in the identification of potential roost suitability (Adams 2003). Because bats spend significant amounts of time roosting they often leave sign, primarily culled insect parts and guano, that can be detected through habitat surveys. All roosting sites are necessary to support a viable bat population and are critical to survival. Different species use varying roost structures and evaluations of potential bat habitat within an area must focus on all types to determine suitability. Some bats use more permanent roost structures (caverns, crevices, buildings, abandoned mines) while others utilize provisional types (dead trees, live trees, shrubs).

During the cold season (October–March) bat activity is reduced and is limited only to hibernation, migration, and occasional rousing for water. Any survey of bat activity in the cold season should focus on roosting habitat where these three behaviors are performed. Our bat use surveys in Rilda Canyon focus on habitat availability and the presence of migrating, hibernating or

watering behavior to evaluate possible impacts of the expansion of mining activity in the canyon. These cold season surveys focus on potential habitat due to minimized activity in the cold season. Previous bat surveys were conducted in the warm season (June-September) in Rilda Canyon and surrounding areas (Sherwin et al. 1997). These surveys focused on netting and acoustic detection of bat communities and yielded information on warm season activity within Rilda Canyon (Sherwin et al. 1997). Warm season activity discussions are based on the Sherwin et al. 1997 bat survey results.

Methods

We conducted bat roosting habitat, acoustic and capture surveys of the riparian corridor and adjacent cliff faces in Rilda Canyon, Emery County in the cold season of 2004. We conducted roosting habitat surveys on October 22, 23, 24 and 25. We also conducted acoustic and capture surveys on October 22, 23 and 24. Due to the late season timing of the survey we focused our efforts primarily on the presence of suitable warm and cold season bat roosting habitat. Roost habitat surveys consisted of evaluating cliff bands, standing dead trees and large standing live trees for potential roosting sites and bat sign. Water surveys consisted of evaluating riparian the corridor looking for open areas with flat water surfaces to assess water availability. More detailed habitat survey were conducted around the "fan portal," "intake portal," "bath house," "parking garage" and "powder house" proposed development sites. These site names are based of site location markers found within Rilda Canyon and may vary with updated records. In order to assess potential bat habitat in Rilda Canyon, we took measures of the size shape and thermal properties (aspect, depth, microclimate conditions) of any available roosting habitat and noted access to water and suitability of each site. We also evaluated habitat factors in the areas surrounding Rilda Canyon to determine if the habitat is unique to the areas of proposed development.

We assessed the available habitat based on the requirements of a subset of bat species of conservation interest (*Nytctinomops macrotis, Coynorhinus townsendii, Myotis thysanodes, Euderma maculatum, Idionycteris phylotis, and Lasiurus blossovillii)*. These six bat species are of

particular concern in Utah and are the species likely to be effected by mine expansion within Rilda Canyon. In Utah, these species show limited distributions, low population densities and/or exhibit specific habitat requirements that may be impacted by the proposed mining development within the canyon. We assessed Rilda Canyon for the habitat requirements specific to each of these bat species of concern:

The Big free-tailed bat (*Nytctinomops macrotis*) is a large high flying species with a long narrow wing-span. This bat is distributed from northern Mexico to western Utah and southern Colorado migrating from northern locations to southern Locations in the cold season (Milner et al. 1990, Adams 2003). The Big free-tailed bat typically roosts in cervices and occasionally in buildings and small caverns (Milner et al. 1990, Adams 2003). This species is often associated with elevations below 6000 feet (Adams 2003). In Utah, this species is rare and is usually found in rocky landscapes with high cliff walls (Adams 2003). It uses these high cliff walls to drop into flight because of its large size thus it commonly selects roosts and habitat that possess this feature.

The Townsend's big-eared bat (*Coynorhinus townsendii*) is a broad-winged bat with large ears and is well suited for slow flight (Kunz and Martin 1982, Adams 2003). Townsend's big-eared bats are distributed throughout western North America and in two isolated populations in the east and Midwest (Kunz and Martin 1982). The southwestern edge of this species range is the Isthmus of Tehuantepec in central Mexico (Kunz and Martin 1982). This species is a cavern roosting obligate requiring the thermal insulation of caverns to digest, hibernate, and carry out maternity behavior (Kunz and Martin 1982, Adams 2003). In Utah, this species is often found rooting in areas with an abundance of abandoned underground mines (Adams 2003). Townsend's big-eared bats move little between summer and winter roosts but are known to use several roosts during the summer months (Humphrey and Kunz 1976, Adams 2003). The average movement of Townsend's big-eared bats between summer maternity and winter hibernation roosts is only 8 miles (Humphrey and Kunz 1976). This small migration distance means that this species must have several suitable caverns to carry out both maternity and hibernation activity within a local area.

Fringed myotis (*Myotis thysanodes*) is a small highly maneuverable bat species with short broad wings (Adams 2003). This myotis feeds primarily on beetles and moths directly above the vegetation canopy in Pinyon pine Juniper to Spruce Fir forests (O'Farrell and Studier 1980, Adams 2003). Fringed myotis are distributed episodically between Mexico and British Columbia (O'Farrell and Studier 1980, Adams 2003). This species typically roosts in caves, mines and buildings thus requiring the thermal properties these roosts provide (O'Farrell and Studier 1980, Adams 2003).

The Spotted bat (*Euderma maculatum*) is a broad-winged bat with large ears suited for low and slow flight (Adams 2003). However it is a fast and highly maneuverable species in contrast to its physical characteristics (Watkins 1977). This species has been recorded at a myriad of elevations between northern Mexico and southern British Columbia in the west (Watkins 1977, Adams 2003). In Utah, this species is rare and is usually found in rocky desert landscapes of the west and southwest that possess high cliff walls (Adams 2003). It also uses high cliff walls to drop into flight because of its large size hence it commonly selects roosts and habitat that possess this feature.

The Allen's big-eared bat (*Idionycteris phylotis*) is a broad winged big-eared bat suited for fast highly maneuverable flight (Adams 2003). This species feeds primarily on small moths and beetles (Czaplewski 1983, Adams 2003). Allen's big-eared bats are associated with xeric forest habitat from Pinyon pine and Juniper to mixed conifer forests from northern Mexico across Arizona to southeastern Utah (Czaplewski 1983, Adams 2003). This species appears to day roost in crevices, caves and abandoned mines and is typically associated with rocky areas with high cliffs (Adams 2003). Allen's big-eared bats have also been known to roost in pine snags, beneath overhangs and under boulders (Adams 2003). Little is known about this species but it often occurs in desert habitat (Adams 2003).

The Western red bat (*Lasiurus blossovillii*) has a long broad wing-span suited for fast flight below a canopy. This species is distributed from northern Mexico though Arizona to northwestern Utah (Adams 2003). The Western red bat is generally found in mesic habitat along stream corridors or on the boundaries of forests or agriculture areas (Adams 2003). This bat

typically roosts in tree foliage and in large shrubs along riparian corridors (Adams 2003). In Utah, few Western red bats have been captured in the southern most portions (Adams 2003) One Western red bat was captured in Carbon County (Oliver 2000).

Habitat in the vicinity of Rilda Canyon was evaluated on the basis of the habitat requirements of each of the species of concern. The relationship of the habitat to the proposed development area within the canyon was evaluated along the basis of possible habitat impacts.

Results

AREA HABITAT:

Acoustic bat detection surveys yielded no records of bat activity within Rilda Canyon in the cold season. Capture surveys also produced no bats in the cold season. Fortunately, habitat surveys yielded a clear picture of the roosting habitat availability within Rilda Canyon. The Canyon is characterized on a broad scale by a riparian corridor at the base of the canyon with variations in cliff structure and vegetation existing on the northern and southern canyon sides.

The riparian corridor at the base Rilda Canyon is characterized by a small perennial stream. The stream bank vegetation consists of cottonwood (*Populus angustifolia*), Quaking aspen (*Populus tremuloides*), Redosier dogwood (*Cornus sericea*), Wild rose (*Rosa woodsii*), sagebrush (*Artemisia spp.*), Snowberry (*Symphoricarpos oreophilus*), Ponderosa pine (*Pinus ponderosa*), Rubber rabbitbrush (*Chrysothamnus nauseosus*) and Blue spruce (*Picea pungens*) vegetation. The stream was fast flowing and shallow throughout the lower two thirds of the canyon. While in the upper third of the canyon the stream does not flow at the surface. Within the portion of flowing stream five specific areas appeared to be suitable bat watering habitat (see map).

The southern side of Rilda Canyon within the project area is characterized by a mixed conifer forest and several small cliff bands (see map). The forest consists of Douglas fir (*Pseudotsuga menziesii*), subalpine fir, Engelmann spruce (*Pinus engelmannii*), White fir (*Abies concolor*) and Limber pine (*Pinus flexilis)* with standing dead Douglas fir and/or Blue Spruce

making up 15-20% of the forest. The smaller southern cliff bands consist of 20-70 foot high rock faces mid-way between the stream corridor and the ridgeline.

The northern side of Rilda Canyon consists of Pinyon pine (*Pinus edulis*) and juniper (*Juniperus scopulorum J. osteosperma*) woodland with associated cliff bands of varying heights ranging from 50-70 feet to over 100 feet. The woodland consists of ponderosa pine, Pinyon pine, Utah juniper, Mountain juniper and Curlleaf mountainmahogany (*Cercocarpus ledifolius*) and several large Ponderosa pine and standing dead Engelmann spruce are present at the canyon's rim.

ROOSTING HABITAT:

We evaluated crevices and overhangs for potential bat roosting habitat throughout the northern side of Rilda Canyon. Crevices around the "fan portal," "intake portal," "bath house," "parking garage," and "powder house" proposed development sites ranged in height from a few feet to over 50 feet with depths varying from a few inches to over 10 inches. Small amounts of guano were found at the base of several of these crevices but no large concentrations were found. The guano characteristics suggest use of the area by a *Myotis* species (*M. thysanodes, M. volans etc*). No large overhangs were located in close proximity to the proposed development sites.

A limited amount of cavern habitat was observed within close proximity of the proposed development sites. One cavern measuring 4 feet high by 3 feet wide and 6 inches deep was found on the southern cliff band east of the "bath house" site. A second man made cavern measuring 10 feet high by 10 feet wide by 10 feet deep was located in a reclaimed adit up canyon from the "parking garage" site. No bat sign was detected at either of these caverns however the larger cavern appears to be suitable roosting habitat for future bat use.

We found standing dead trees primarily along the riparian corridor with little or none around the proposed development sites. Several large live Ponderosa Pine trees were found within the proposed construction sites. No bat sign was detected around these potential roosting sights but it is inherently difficult to observe low amounts of bat sign in the canopy from surveys conducted at ground level.

The canyons aspect plays a role in roost suitability and may influence season of use within the canyon. The northern side of the canyon possessed significant amounts of cliff roosting sites with the variety of cliff bands present. The aspect of the northern slope suggests bat use occurring primarily in the warm season. The potential roosting habitat exhibits suitable thermal warming by the sun in the summer that would buffer the shallowness of the crevices present thus aiding in the microclimate suitability of these roosts. These qualities are not present in the cold season with differing solar radiation levels thus it is likely bat use occurs in the warm season on the north side of Rilda Canyon.

The aspect of the southern slope suggests bat use occurring primarily in the cold season. The potential habitat exhibits suitable hibernation conditions with less solar exposure thus cooler temperatures necessary for over-wintering bats. The southern slope suggests heavy use by tree roosting bat species as trees are more plentiful. It is likely bats use occurs in the warm and cold season on the south side of Rilda Canyon.

The warm season bat surveys conducted by Sherwin et al. found only one species of concern using Rilda Canyon (1997). Spotted bats were acoustically detected within the canyon but in low numbers in the warm season (Sherwin et al. 1997). They suggest that no fewer than 3 individuals were in the area and that these bats could tolerate moderate human disturbance while foraging (Sherwin et al. 1997). The remaining species detected in the warm season either by netting or acoustic surveys were species not of conservation concern (Sherwin et al. 1997) and warrant no further consideration for disturbance.

WATER SITES:

Five areas providing suitable watering habitat were observed in the stream in Rilda Canyon (see map). These watering sites were free from vegetation clutter and possessed surfaces that were calm. These suitable water sites were located down canyon from proposed mine development sites but may be affected by road expansion often associated with improvements.

Discussion

ROOSTING HABITAT:

The habitat available in Rilda Canyon is suitable for a subset of bats of conservation concern although no bats were directly observed in the cold season. Roosting habitat characteristics suggest suitability to several of theses species but warm season surveys conducted by Sherwin et al. found only a small number of Spotted bats using the area (Sherwin et al. 1997). Rilda Canyon's bat habitat is characterized by the presence of cliff bands, cervices several small caverns, standing dead and standing live trees (see map). High cliff bands with crevices suggest possible roost use by Big free-tailed bats and Spotted bats. Spotted bats have been acoustically detected within Rilda Canyon but in low numbers (Sherwin et al. 1997). Smaller cliff bands, overhangs and boulder fields suggest possible roost use by Fringed Myotis and Allen's big-eared bats. Guano characteristics found in the cold season surveys suggest use by an unknown Myotis species. Sherwin et al. netted several species of Myotis within the area, none of which were species of concern (1997). Standing dead and standing live trees suggest possible roost use by the Western Red bat. One cavern was located which suggests potential roosting habitat for Townsend's big-eared bats although this is unlikely since no bat sign was detected within.

Area surveys show that the roosting habitat in Rilda Canyon is also available to bats throughout the area. Cliff bands, caverns, standing dead and standing live trees are present within the main canyon as well as in nearby side canyons. Any alterations to these structures can be mitigated by the presence of roosting habitat in the mouth or outside of Rilda Canyon. Any alterations on the local scale may be mitigated by the presence of alternative habitat since no significant roosts were detected by cold season surveys within close proximity to the proposed development sites.

WATER SITES:

Five areas were observed that would provide suitable watering sites within Rilda canyon. All suitable watering sites were well below the proposed mining development areas. These sites may be affected by road improvements thus disturbance must be minimized at kept at the local

scale around proposed development areas. Care should be taken to maintain "normal" water flow along the stream to maintain the characteristics bats require for watering sites. Any debris in the stream may choke the flow and alter patterns of stream flow along the tributary. Fortunately, area surveys show that water is also available to bats outside of Rilda Canyon. Huntington Creek running at the mouth of Rilda Canyon provides an additional area for bats to obtain water. The wetlands to the east of Rilda Canyon are an excellent source for bats with wide approach areas and calm surfaces. Warm season surveys show that these external water sources are suitable as detected through netting and acoustic techniques (Sherwin et al. 1997).

The bat roosting habitat and watering sites are not unique to Rilda Canyon but care should be taken to minimize disturbance outside proposed development areas. Disturbance should be kept on the local scale to maintain mitigation habitat that currently exists in the surrounding area. Concentrating improvements to the areas proposed will likely affect only local populations but if kept at a minimum it will impact only those bats that may be in the immediate area. No significant bat roosts were located within the proposed development sites but this does not mean the area is free from bat use. Some bats are more solitary and can roost singly or in small groups. These small groups are difficult to locate with simple habitat surveys and thus remain a concern. An abundance of mitigation habitat is present within and outside of Rilda Canyon that will buffer impacts to bats on the local scale by providing alternative roosting sites in areas away from the disturbance. These mitigation sites outside of Rilda Canyon must be preserved to maintain roosting suitability in these areas to provide an escape from disturbance in the area. It is likely that bats will be able to exit the area and relocated in suitable roosts outside Rilda Canyon with little impact to their survival.

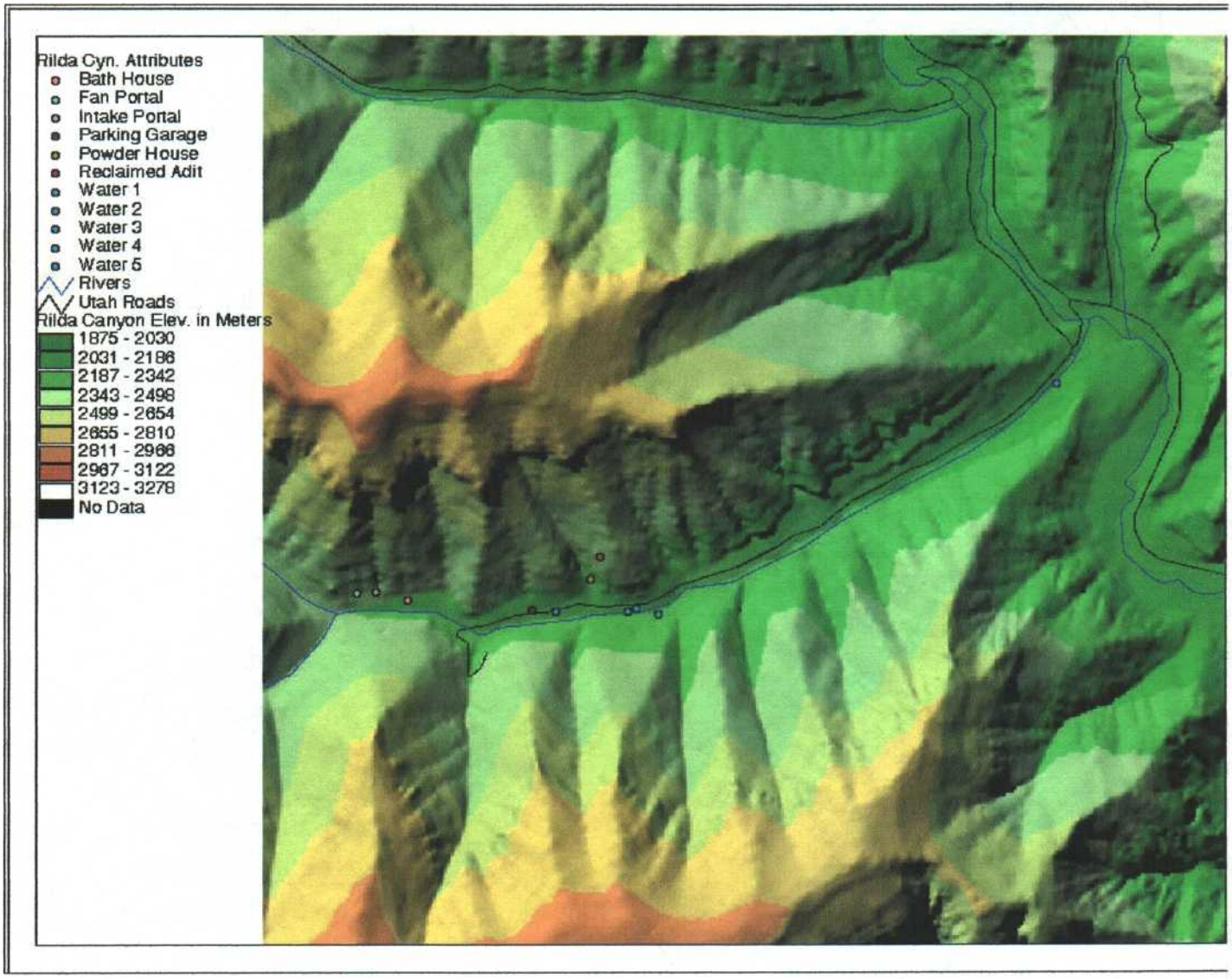
One large cavern habitat was located within Rilda Canyon providing unique habitat for bat use. This large cavern is the reclaimed mine adit up slope from the "powder house" proposed site. It is the largest cavern habitat in the area and may provide future roosting habitat to those bats that utilize this type of roosting conditions. Care should be taken to maintain this cavern as it is unique to the area. No bat activity was detected within this cavern thus maintenance of this site will be only for the benefit of future bat use.

Standing dead and live trees were detected in all of the proposed development sites. Not all observed trees appear to provide suitable roosting habitat and are not in need of protection. Preservation of trees within close proximity to the proposed development sites is not necessary as no bat activity was detected within the improvement areas. It is likely that any tree roosting bat activity will be buffered with large trees present at the outside of mining impact area proposed for Rilda Canyon.

Capture and acoustic surveys did not detect bats but that is likely due to inclement weather and time of season. Many bats are hibernating or have migrated from the area this late in the season. Some bat sign (guano) was detected within the canyon but positive identification is unlikely solely with guano characteristics. Warm season surveys conducted by Sherwin et al. yielded the detection of only one of the species of concern using Rilda Canyon (1997). The Spotted bat was detected but only in limited numbers and is believed to forage within the canyon (Sherwin et al. 1997). They suggest that the Spotted bat is able to tolerate moderate disturbance when foraging (Sherwin et al. 1997) and thus is likely to be unaffected by the proposed mining development.

The bat roosting habitat in Rilda Canyon is not unique to the area but is being used in low levels by bats as detected by the observation of guano in crevices. Disturbance outside of the area of development should be minimized and allow for mitigation of roosting habitat for future bat use. Alterations to Rilda Canyon are likely to impact only resident bats within close proximity to development but can be mitigated by surrounding habitat at the mouth or outside of the canyon. Previous surveys have detected only the Spotted bat in low numbers but habitat does exist for use by all species of concern. This does not mean it is being used by species of concern but it remains plausible. Disturbance should be minimized in the surrounding areas to maintain integrity of future roosting and allow for mitigation of any habitat lost through development.

Map of Rilda Canyon, Emery County Utah, showing proposed development sites and watering sites with respect to bat habitat surveyed.



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R645-301-300 BIOLOGY SECTION

APPENDIX H
RAPTOR SAFE POWERLINES

♦ **Guidelines For Managing Birds on Powerlines, PacifiCorp, effective date: 2/15/99**

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1.1 PURPOSE

Bird Mortality

Bird mortality due to electrocutions and collisions with power lines has received considerable attention over the years by utilities, agencies, and the public. Concern for the welfare of wildlife promotes a positive public image, contributes to system reliability, and complies with PacifiCorp Policy (2.5.11).

Mortalities of large birds due to electrocution or collision with power lines are managed in accordance with state and federal laws, and to ensure more reliable customer service by reducing the incidence of bird-caused outages. Bird mortalities usually involve electrocution of raptors (hawks, eagles, etc.) due to their habit of using power poles for resting and hunting perches, or collisions with conductors or shield wires by waterfowl. Electrocutions generally are isolated and associated with the distribution system ($\leq$ 34.5 kV), however some electrocutions have been documented on lower voltage transmission structures ($\leq$ 69 kV). Collisions by waterfowl usually occur near wildlife refuges or other bird concentration areas near wetlands. Waterfowl generally collide with lines as the birds rise to avoid the conductors and strike the shield wires, especially at night or under conditions of poor visibility (e.g., fog, inclement weather).

Bird Nests

Nesting by osprey and other large birds has been associated with problems of service reliability and legal compliance. Power poles provide ideal nesting structure, and may enhance raptor populations where nesting habitat is lacking. However, if the nest poses a present or future threat to electrical operations, action must be taken. The objective is to take the appropriate action before the nest becomes a problem. This will avoid possible delays due to permitting requirements and reduce the probability of a nest-caused outage.

Company Program

Growing concern over the incidence of bird mortalities and problem nests, and resulting outages, required development of a company-wide program of reporting and documentation. The purpose of this program is to assist field personnel in managing bird/powerline situations and to document the incidence of mortalities and problem nests of raptors and other large birds. Documentation provides the basis for proactive management. It also provides a means to determine the number of bird-caused line outages and to reduce their impacts to system reliability. The emphasis herein refers to large birds (e.g., raptors, waterfowl, cranes, etc.); these guidelines do not address the management of small bird problems, such as starlings or other songbirds.

These guidelines describe procedures for dealing with mortalities of large birds and problems associated with their nests. It is distributed to the Operations Managers throughout PacifiCorp service territory to assist them in their operations. It is the responsibility of the Operations Manager to impart this information to their personnel. The Environmental Services Department (ESD) is available to provide any necessary assistance and training (see Sections 1.3 and 1.4). It is hoped that this document will serve as a reference to assist field personnel in managing bird/powerline situations.

Reporting

Reporting of bird mortalities and problem nests is linked to the outage reporting system. Reports were incorporated into the Distribution Management and Information Retrieval System (DMIRS) in April 1988 (Pacific Division) and April 1990 (Utah Division). The outage reporting system has been configured to accept data on bird mortalities that relate to both outage- and non-outage situations. Mortalities of birds are to be entered in the outage reporting system, even when not related to an outage (see Section 2.2.3).

1.2 DEFINITIONS

Raptors - Birds of prey with hooked beaks and talons for grasping and killing prey; includes eagles, hawks, falcons, owls (see Section 4). Raptors frequently use power poles for perching or nesting. Osprey, a large fish-eating hawk, is the most common hawk that nests on power poles.

Problem nest - A nest that may cause electrocution and death to the birds; electrical outage, property damage, or otherwise interfere with power operations.

Occupied nest - A nest with an incubating adult (sitting on eggs), or eggs or young present. Term is used synonymously with active nest. Nests may be occupied during the breeding season (approximately February through August).

Threatened and endangered species - Species that are threatened with extinction and protected by federal law (Endangered Species Act; see Section 5). Because golden eagles may be similar in appearance to bald eagles, all eagles are protected (Eagle Protection Act; see Section 5). For more information, contact ESD, Portland/Salt Lake City.

State species of special concern - Species that are locally threatened or otherwise protected within certain states. Respective state agencies may require reporting of mortalities or problem nests of these species. For more information, contact ESD, Portland/Salt Lake City.

Imminent danger - Due to the presence of a bird nest, there exists imminent danger of fire or electrocution to the birds, or immediate threat to human life or property. **This is considered to be an extremely exceptional situation**.

1.3 ESD CONTACTS

Contact **Monte Garrett**, (Portland, 503-813-6629) or **Jim Burruss** (Salt Lake City, 801-220-2535), of the Environmental Services Department (ESD) regarding mortalities of eagles or endangered species (see Section 5), or to obtain a permit to manage an occupied nest. ESD will arrange for the disposal of carcasses of eagle/endangered species, and secure a permit to manage occupied nests through the U.S. Fish & Wildlife Service (USFWS).

If Monte Garrett or Jim Burruss are not available at the time of the call, leave the information with a secretary (Deborah Wright, Portland, 503-813-6611 or Martha Kinsman, Salt Lake City, 801-220-2196). The caller should specify, **"This is a bird/powerline call"** to ensure the message receives proper attention. Necessary information will be collected at this time, or the call will be returned as soon as possible.

1.4 TRAINING

Previous versions of these guidelines have been distributed to each district. This update is intended to replace previous versions. A training video describing the issues and procedures for bird/powerline management has also been distributed to each district. An updated version of the video and online training on ESD's website is scheduled for 1999. ESD will provide training or technical assistance concerning bird/powerline issues upon request by contacting Monte or Jim. Billfold-sized laminated cards that provide a flow chart for making bird/powerline management decisions are available for distribution to field personnel.

These guidelines have attachments to aid in design of nest platforms, information on commercially available products to remediate problem poles, examples of raptor-safe distribution construction standards, and identification of birds. Additional copies of the attachments are available upon request.

1.5 OBTAINING COPIES OF THIS MANUAL

To obtain copies of this manual, contact **Monte Garrett**, (Portland, 503-813-6629). Please provide the following information when making the request:

1. Name
2. Cost Center
3. District
4. Department name
5. Mailing address

2.1 PROBLEM NESTS

These guidelines apply only to problem nests. Nests not interfering with power operations should be left in place. If a problem with a specific nest is anticipated in the future, permit requirements may be avoided by taking the appropriate action during the non-breeding season before the nest is occupied. The breeding season for most raptors falls between February 1 and August 31. If there are questions whether a problem nest is active or inactive, call ESD. Specific details concerning nests that cause sustained outages should be recorded on the appropriate form and reported through the outage reporting system (see Sections 2.2.3 and 7).

Prior to any action on a problem nest, personnel are required to determine:

1. The bird species using the nest. Is it an eagle or endangered species nest? (Refer to Section 5 for names of endangered/threatened species and states of occurrence).

2. The status of the nest. Is it occupied (incubating adult, eggs, or young present)?

The following procedures should be followed based on the species of bird using the nest and the status of the nest.

2.1.1 Non-Eagle and Non-Endangered Species

2.1.1.1 Unoccupied Problem Nest

A permit is not required to remove or manipulate an unoccupied problem nest for a non-endangered or non-eagle species. Reoccupation and rebuilding of nests during subsequent breeding seasons is common, however, and simply removing an unoccupied nest may not be a long-term solution.

There are several management options to consider, depending on the particular situation. Constructing a nest platform (see Section 8) or modifying the pole to accommodate both nest and power operations usually prevents future complications and minimizes costs. ESD is available for consultation and recommendations.

2.1.1.2 Occupied Problem Nest

All occupied nests are protected by the Migratory Bird Treaty Act. A permit issued by the USFWS is required before managing an occupied nest. Contact ESD to obtain a federal permit prior to management action except in situations of imminent danger.

In the **extremely exceptional case of imminent danger**, nest material may be trimmed, conductors moved, or other appropriate action taken immediately prior to receiving a permit. Practices to ensure the welfare of young birds, if present, must be followed. Any action taken on an occupied nest prior to ESD notification is highly unusual, and extreme caution is recommended to protect eggs or young and avoid violation of federal law. Contact ESD as soon as possible after the action has been taken, so that the necessary permit can be obtained.

In summary, when managing an **occupied** problem nest:

1. Contact ESD before conducting action.

2. ESD will obtain federal permit.

3. ESD will provide guidelines/recommendations for management action.

2.1.2 Eagle or Endangered Species Nest

All nests of eagles (golden and bald) or endangered/threatened species (see Section 5) are protected by federal laws regardless of whether the nest is unoccupied or occupied. Violations may result in heavy fines to the company and/or the employee. Although an eagle nest on a power pole is uncommon, contact ESD for confirmation if a problem nest is suspected to be that of an eagle or endangered species. ESD will obtain a federal permit prior to management action, or immediately following the action in situations of imminent danger.

In the **extremely exceptional case of imminent danger**, nest material may be trimmed, conductors moved, or other appropriate action taken immediately. Practices to ensure the welfare of young birds, if present, must be followed. Any action taken on an occupied nest prior to ESD notification is highly unusual, and extreme caution is recommended to protect eggs or young, and avoid violation of federal laws. Contact ESD as soon as possible after action has been taken, so that the necessary permit can be obtained.

Problem Nest Summary for an occupied nest or any eagle/endangered species nest:

1. **Contact ESD before conducting action.**

2. **ESD will obtain federal permit.**

3. **ESD will provide guidelines for management action.**

2.2 BIRD MORTALITIES AND INJURED BIRDS

2.2.1 Dead Birds

Personnel discovering a raptor or other large bird mortality located within company facilities or rights-of-way are required to fill out the appropriate reporting form (see Section 7). The reporting form shall be forwarded to appropriate personnel for subsequent entry into the outage reporting system. If the mortality is an eagle or endangered species (i.e., peregrine falcon), notify the Operations Manager immediately. The Operations Manager or his/her representative must then report this to ESD.

2.2.2 Injured Birds

Personnel discovering an injured bird within company facilities or rights-of-way will contact the Operations Manager immediately. No attempt shall be made to capture or restrain the injured bird. If a qualified rehabilitator is available in the local area, the Operations Manager will contact the rehabilitator and provide information for retrieval of the injured bird. If appropriate person(s) are unknown or unavailable, ESD shall be contacted as soon as possible.

2.2.3 Marked or Banded Birds

Dead birds found by company personnel shall be inspected for the presence of any special leg bands, markers, or neck collars. Marked birds shall be left on site and the Operations Manager will be notified. The location of marked birds must be submitted to the USFWS or local state agency (Section 6). Contact ESD as soon as possible.

2.2.4 Documentation

Documentation of bird mortalities (Section 2.2.6) is integrated with the outage reporting system (DMIRS), because these occurrences frequently result in either sustained or momentary service outage. However, all mortalities of large birds found near company facilities must be documented (entered into DMIRS), even when no known outage has occurred. Each incident of a bird mortality must be recorded on the outage reporting form (Section 7) prior to disposal.

2.2.5 Disposal

Under no circumstances should company personnel remove or have in possession the carcass of a dead bird, unless specifically arranged with ESD and the USFWS. It is a violation to take (kill, transport, sell, or possess), regardless of intent without proper permits or authorization.

2.2.5.1 Non-Eagle/Non-Endangered Species

This refers to all owls, hawks, waterbirds, and ravens except those species listed in Section 5. Company personnel discovering mortalities of these birds should bury or dispose of the carcass on site without transporting, **unless the carcass has a leg band or other special marker** (Section 2.2.1.3). If it is not possible to bury or dispose of the carcass, leave it on site and notify the Operations Manager. The Operations Manager or his/her representative can then contact ESD for assistance in removing the carcass from the site. This procedure has been approved for all birds, except eagles and endangered species, by respective state agencies and the USFWS.

2.2.5.2 Eagle/Endangered Species

When an eagle or endangered species is found, the carcass must be left on-site. It may be moved to a safe place at the base of the pole, but do not bury. The Eagle Protection Act requires the USFWS to investigate all eagle mortalities. The investigation frequently requires an autopsy of the carcass to determine cause of death.

As indicated above, the Operations Manager must be notified regarding all eagle or endangered species mortalities. The Operations Manager or his/her representative will contact ESD; ESD will coordinate disposal of the carcass with the USFWS representative.

A guide to assist in identification of birds of prey is in Section 4. A list of endangered/threatened species found in the PacifiCorp service area that requires immediate notification to ESD is in Section 5, and additional information and training on identification of eagles and endangered species is available on request from ESD.

Bird Mortality Summary:

1. **Do not remove carcass of a dead bird from the site.**

2. **If possible, bury or dispose of the carcass on site without transporting unless eagle or endangered species, or unless the carcass has a leg band or other special marker.**

3. **If eagle or endangered species, or the carcass has a leg band, notify ESD as soon as possible.**

4. **Operation Manager or his/her representative must contact a local rehabilitator or ESD regarding the location of an injured bird.**

5. **The mortality must be documented through the outage reporting system (DMIRS), even when there is no known outage.**

2.2.6 Reporting

Bird mortality data must be entered in the outage reporting system in accordance with operating instructions presented in the DMIRS manual. A summary of these procedures is presented below for outage and non-outage related bird mortalities, and outage related problem nests. The first procedure pertains to a bird mortality (or problem nest) located within company facilities or rights-of-way that caused an outage. The second procedure pertains to a bird mortality found within company facilities or rights-of-way that is **not directly related to a sustained outage but also must be entered into the outage reporting system**.

2.2.6.1 Outage Related Bird Mortality/Nest

PacifiCorp personnel discovering a mortality of a large bird (or problem nest) directly related to an outage will enter the information on the Outage Report (Section 7). That data will then be entered into DMIRS as follows:

1. Access the mainframe computer by typing ADR on the command line.
2. After entering name and password, choose DMIR from the screen menu.
3. Choose option 6 from the DMIRS SYSTEM MENU.
4. Choose option 6.1 (Sustained Line Outage) from the Distribution Outage System menu.
5. Enter Function (A), Circuit, Date, and Time of outage.
6. Choose the appropriate service territory (e.g., COPCO, PPL, UPL) and enter in Screen Format
7. Choose "Outage" and enter in Next Screen
8. Enter # Customers Off, and the appropriate System Section code (defined on back of form).

9. Enter the appropriate bird Cause code; for example:

   3031 EAGLE
   3032 HAWK/OSPREY
   3033 OWL
   3034 FALCON
   3035 WATERBIRD (DUCKS, GEESE, HERONS, GULLS)
   3036 CROW/MAGPIE/RAVEN
   3037 UNKNOWN BIRD
   3038 BIRD NEST

   3029 SMALL BIRD*
   *other birds not listed above

   Note: If the mortality is an eagle (bald or golden) or possible endangered species (i.e., falcon), the Operations Manager or his/her representative must contact ESD immediately (see Section 1.3).

10. Enter the appropriate Part Failed and Protective Device codes (defined on back of form).

11. Enter Map Number, Pole Number, and/or Address, depending on the service territory (i.e., much of the UPL service territory does not have pole numbers).

12. Complete the Restoration section (see DMIRS manual for detailed instructions).

13. From the visual signs of death listing on the form, "X" the appropriate code.

Entering bird Cause codes will require filling out the visual signs of death. Cause code 3038 only refers to bird *nests* that cause outages; the visual signs of death need not be completed for nests.

2.2.6.2 Non-Outage Related Bird Mortality/Nest

PacifiCorp personnel discovering a mortality of a large bird (or problem nest) directly related to an outage will enter the information on the Outage form (Section 7). That data will be entered into DMIRS as follows:

1. Access the mainframe computer by typing ADR on the command line.

2. After entering name and password, choose DMIR from the screen menu.

3. Choose option 6 from the DMIRS SYSTEM MENU.

4. Choose option 6.3 (Bird Mortality / No Outage) from the Distribution Outage System menu.

5. Enter Function (A), Circuit, Date, and Time of outage.

6. Enter the appropriate bird Cause code; for example:

   3031 EAGLE
   3032 HAWK/OSPREY
   3033 OWL
   3034 FALCON
   3035 WATERBIRD (DUCKS, GEESE, HERONS, GULLS)
   3036 CROW/MAGPIE/RAVEN
   3037 UNKNOWN BIRD
   3038 BIRD NEST

   3029 SMALL BIRD (NOT REPORTABLE)*
   *other birds not listed above

   Note: If the mortality is an eagle (bald or golden) or known endangered species (i.e., peregrine falcon), the Operations Manager or his/her representative must contact ESD immediately (see Section 1.3).

7. Enter Map Number, Pole Number, and/or Address, depending on the service territory (i.e., much of the UPL service territory does not have pole numbers).

8. From the visual signs of death listing on the form, "X" the appropriate code.

3.1 MODIFICATION OF EXISTING FACILITIES

Modification of existing facilities is necessary when problems persist in certain areas or concerns of legal compliance are at issue. The need for this remedial action may result when "problem poles" are identified through the DMIRS database, or when the company is notified by agency representatives or concerned customers. The effect of birds on system reliability may also result in requests from operations personnel.

The objectives of remedial action are:

1. to provide a 60-inch (1.5-m) minimum separation between conductors and/or grounded hardware;

2. to insulate hardware or conductors against simultaneous contact if adequate spacing is not possible;

3. to increase the visibility of conductors or shield wires to prevent avian collisions; or

4. provide safe locations for perching or nest construction.

3.1.1 Site-specific Plans

The factors that create a hazard for birds near power lines are complex and site-specific. Therefore, the most efficient solution for correcting a problem line is a site-specific plan that satisfies unique site conditions (i.e., topography, local prey populations, land use practices, line configuration, etc.). The plan is comprised of the most appropriate remedial action to the poles or lines causing the problem and a timetable for job completion. When a problem area is identified, a site meeting may be conducted. PacifiCorp engineering and operations personnel in attendance will provide guidance on line modifications, and company biologists will provide input on biological aspects of the affected species. The timeframe for action will be based on agency requests, public relations, budget and manpower constraints, as well as biological considerations that affect species vulnerability. The application of remedial measures to a few "problem poles" or spans usually reduces problems over a wide area.

3.1.2 Bird Collisions with Existing Lines

Collisions by birds with overhead wires is typically a problem involving large-bodied, less maneuverable birds, or species that fly at high speeds and at low altitudes, in areas of high concentration (for example, waterfowl near wetland areas). Many factors influence the likelihood of collisions with overhead wires. These include characteristics of the species involved (e.g., use of habitat, body size and flight behavior, age, time of day) as well as

environmental characteristics (e.g., weather, land use practices, line configuration and placement). The proximity of the line to high-use areas, vegetation that may attract the birds, and topographical features that affect local and migratory movements should be considered when determining the extent of necessary remedial action.

The risk of collisions may be reduced or eliminated by burying the line, reconfiguring the line, removing the overhead ground wire, or marking the line to increase visibility. Because in most instances remediation of only a few spans will eliminate the problem, burying or reconfiguring the line are not cost-effective solutions. Removal of the overhead ground wire also may not be feasible due to operational or safety concerns. However, research indicates that marking the shield wire (transmission lines) or conductors (distribution lines) to increase visibility significantly reduces the incidence of avian collisions. For recommendations regarding installation, contact ESD.

Marker balls, spiral vibration dampers, or other similar devices (e.g., bird flight diverters) are commercially available products to increase the visibility of overhead wires to birds. These products may be ordered from Materials Management or directly from the manufacturers (see Section 8).

3.1.3 Electrocution of Birds on Existing Lines

Most birds that are electrocuted on power lines are raptors. Two principal factors contributed to the electrocution of raptors. First, these birds are opportunistic and are attracted to power lines for purposes of hunting perches or nesting substrate (especially in open country where such substrate is lacking). Second, many power line configurations place conductors and other energized and grounded hardware close enough together that the birds make simultaneous contact with their wings and other body parts.

Retrofitting only a few poles can significantly reduce most electrocution hazards on existing lines. These include transformer poles and three-phase poles in which 2 conductors are located on 1 side of the crossarm. Perch guards, conductor covers, and insulation products (for jumper wires, transformer bushings, etc.) are commercially available products that may be ordered from Materials Management or directly from the manufacturers (see Section 8).

3.1.4 Nests on Power Lines

Raptors, and occasionally other species, frequently benefit from the presence of power lines by utilizing distribution poles and transmission structures for nesting. Although electrocution of birds that nest on power lines is infrequent, bird nests can cause operational problems when nest material spans the distance between conductors and causes outages. Removal of nests generally does not solve the problem because most species are site-tenacious and rebuild shortly after the

nest material is removed. There are also regulatory and public relations problems with nest removal. Further, the company has realized public relations benefits by providing nesting locations for these species.

Nesting platforms have been shown to be a valuable tool in dealing with this issue, both in terms of reducing outages and increasing positive publicity. Nesting platforms are generally more necessary on distribution poles (because of closely spaced conductors) than on transmission structures. Platforms provide for the needs of the birds, while preventing electrocutions and electrical outages. Artificial nesting substrate in a variety of designs is accepted by nesting raptors, especially ospreys. Because the birds usually tend to stay at the pole where initial nesting attempts occur, a nesting platform supported above the crossarm on that pole is recommended (see Section 8, Page 5). Although nest platforms are commercially available, it is more cost-effective to construct them with available materials at the service center, or through public outreach activities (i.e., volunteer activities). This also allows the platform to be custom-made for the situation.

There may be times when nesting may be discouraged, although concerns of local customers should be considered if this option chosen. PVC material supported above the crossarm will prevent the placement of nesting material (see Section 8, Page 6).

3.2 RAPTOR-SAFE CONSTRUCTION STANDARDS

When designing or rebuilding power lines in high bird use areas or on federal lands, the same concepts used to modify existing power lines to prevent electrocution also apply to new construction: conductor spacing and grounding procedures. The objective is to provide 60 inches (1.5 m) between energized conductors and grounded hardware, or to insulate hardware if such spacing is not possible. Engineering practices to provide safety for large perching birds is referred to as raptor-safe construction standards (see Section 9). These design standards are consistent with raptor-safe specifications recommended by federal wildlife agencies. This will prevent problems from occurring in the future, both from a legal/public relations aspect as well as in providing reliable customer service.

In areas where birds frequently collide with conductors, or when agencies are concerned about the safety of protected birds (e.g., near wildlife refuges), consideration of appropriate siting and placement will reduce the likelihood of collisions. When possible, avoid areas where birds concentrate (e.g., wetlands, stream crossings) and take advantage of vegetation or topography that naturally shields the birds from colliding with the wires (e.g., placement next to cliffs or trees). If this is not possible, installing visibility devices may reduce the risk of collision. These devices include marker balls or other line visibility devices placed in varying configurations, depending on the line or location (see Section 8). The effectiveness of these devices has been validated by federal and state agencies in conjunction with Edison Electric Institute.

ESD is available for consultation on effectiveness of remedial approaches, and for negotiating cost-efficient site prescriptions with state and federal agencies. Call **Monte Garrett** (Portland, 503-813-6629) or **Jim Burruss** (Salt Lake City, 801-220-2535). Upon completion of any remedial action, the Operations Manager should send a copy of the work order to ESD. This information will document program effectiveness and compliance with state and federal laws. Annual reports of bird mortalities and management actions will be submitted to PacifiCorp district offices, state agencies, and the U.S. Fish & Wildlife Service. All records will be maintained in ESD File WI/PO-BM.

Federal Endangered Species

American brown pelican (*Pelecanus occidentalis*) (CA)
American peregrine falcon (*Falco peregrinus anatum*) (All)
Short-tailed albatross (*Diomedia albatrus*) (CA, OR, WA)
Whooping crane (*Grus americana*) (ID, UT, WY)

Federal Threatened Species

Aleutian Canada goose (*Branta canadensis leucopareia*) (OR, WA)
Bald eagle (*Haliaeetus leucocephalus*) (All)
Marbled murrelet (*Brachyramphus marmoatum*) (OR, WA, CA)
Mexican spotted owl (*Strix occidentalis lucida*) (UT)
Northern spotted owl (*Strix occidentalis caurina*) (OR, WA, CA)

Protected by the Eagle Protection Act

Golden Eagle (*Aquila chrysaetos*) (All)
Bald Eagle (*Haliaeetus leucocephalus*) (All)

Oregon Department of Fish & Wildlife (ODFW)
California Department of Fish & Game (CF&G)
U.S. Fish & Wildlife Service (USFWS)
Washington Department of Fish & Wildlife (WDFW)

District	*State Agency*	*Federal Agency*
Pacific Region		
Portland	Holley Michals, (ODFW) (503) 657-2000 #230	Jerry Woods, (USFWS) (503) 682-6131
Hood River	Jim Torland, (ODFW) (541) 296-4956	
Astoria	Herman Biederbeck, (ODFW) (503) 842-2741	
Albany Lebanon Stayton	Will High, (ODFW) (503) 378-6925	
Lincoln City	Tami Wagner, (ODFW) (541) 867-4741	
Dallas Corvallis	Doug Cottam, (ODFW) (541) 757-4186	
Junction City Cottage Grove	Bill Castillo, (ODFW) (541) 726-3515	
Bend Redmond	Steven George, (ODFW) (541) 388-6363	
Prineville	Brian Ferry, (ODFW) (541) 447-4314	
Hermiston Pendleton Freewater Enterprise	Mark Henjum, (ODFW) (541) 963-2138	
Roseburg	Terry Farrell, (ODFW) (541) 440-3353	Ken Harrington, (USFWS) (503) 883-6900
Coos Bay Coquille	Dan Vandyke, (ODFW) (541) 888-5515	
Medford Grants Pass	Simon Wray, (ODFW) (541) 826-8774	
Klamath Falls	Ron Anglin, (ODFW) (541) 883-5732	
Lakeview	Larry Conn, (ODFW) (541) 947-2950	
Crescent City	Karen Kovacs, (CF&G) (707) 441-5789	Scott Pearson, (USFWS) (916) 979-2987
Yreka Mt. Shasta Tulelake	Richard Callas, (CF&G) (530) 459-5977	
Alturas	Bob Shaefer, (CF&G) (530) 233-3581	
Walla Walla	Pat Fowler, (WDFW) (509) 456-4082	Roger Parker, (USFWS) (509) 928-6050
Sunnyside Yakima Toppenish	Lee Stream, (WDFW) (509) 457-9303	

Idaho Department of Fish & Game (IF&G)
Wyoming Department of Game & Fish (WG&F)
U.S. Fish & Wildlife Service (USFWS)

District	*State Agency*	*Federal Agency*
Wyoming-Idaho Region		
Buffalo Casper Douglas Laramie	Russ Pollard, (WG&F) (307) 777-4579	Dominick Domenici, (USFWS) (307) 261-6365
Cody Lander Lincoln Lovell Rawlins Riverton Rock Springs Sublett Thermopolis Unita Worland	Russ Pollard, (WG&F) (307) 777-4579	Tim Eicher, (USFWS) (307) 527-7604
Oregon Trail Snake River Southgate	Carl Anderson, (IF&G) (208) 232-4703	Steve Magone, (USFWS) (208) 523-0855
Mountain River Rexburg	Jeff Copeland, (IF&G) (208) 525-7290	

Utah Division of Wildlife Resources (UDWR)
U.S. Fish & Wildlife Service (USFWS)

District	*State Agency*	*Federal Agency*
Utah Region		
Layton Ogden Park City Smithfield Tremonton	Lou Cornecelli, (UDWR) (801) 476-2740	Bryce Findley, (USFWS) (801) 625-5572
American Fork Cottonwood Lake Metro Nebo Salina South Valley Timp Tooele Valley West	Bruce Giunta, (UDWR) (801) 489-5678	
Cedar City Delta Milford	Keith Day, (UDWR) (435) 865-6120	
Canyonlands Carbon Castledale	Jim Karpowitz, (UDWR) (435) 636-0260	
Ashley	Steve Cranney, (UDWR) (435) 789-3103	

OUTAGE REPORT

CIRCUIT	DATE	TIME (24HR CLOCK)	GROUP	COMPLETED BY
_____	__/__/____	__/__	_____	_____

# CUSTOMERS OFF	SYSTEM SECTION (A)	PHASES (B)	CAUSE (D)	PARTS FAILED OR DAMAGED (E)	WEATHER (C)
_____	__	___	____	___/___/____	__

PROTECTIVE DEVICE (F) ___ ___ ___

PACIFIC MAP

LOCATION OF TROUBLE	FACILITY POINT	ADDRESS	APT
MAP __.__.__.____	_____	CITY _____ STATE ____	ZIP _____

TRANSMISSION / POLE STRUCTURE	PLANT #	SECT / TAP	STR	MEM
DISTRICT _____	_____	__/__	___/___	__

UTAH MAP

LOCATION OF TROUBLE	FACILITY POINT	ADDRESS	APT
MAP __.__.__.____	_____	CITY _____ STATE ____	ZIP _____

COPCO MAP

LOCATION OF TROUBLE

FACILITY POINT _____ OR __.__.__.__.__.__ CA __.__.__.__.__.__ CY __.__.__.__.__.__

BIRD MORTALITY — FOR ALL EAGLE AND ENDANGERED SPECIES MORTALITIES, CONTACT DISTRICT OPERATIONS MANAGER & ENVIRONMENTAL SERVICES (MONTE GARRETT, JIM BURRUSS)

VISUAL SIGNS OF DEATH ("X" APPROPRIATE OPTION BELOW)

- ☐ COLLISION / BROKEN BONES
- ☐ ELECTROCUTION / BURNS
- ☐ OTHER
- ☐ GUNSHOT / OPEN WOUNDS
- ☐ NONE

FACILITY POINT	ADDRESS	APT
_____	CITY _____ STATE _____	ZIP _____

RESTORATIONS

DATE	TIME (24HR CLOCK)	# CUSTOMERS ON	RESTORE (G)
__/__/____	__/__	_____	__
__/__/____	__/__	_____	__
__/__/____	__/__	_____	__
__/__/____	__/__	_____	__
__/__/____	__/__	_____	__
__/__/____	__/__	_____	__
__/__/____	__/__	_____	__
__/__/____	__/__	_____	__

See reverse side for codes

Outage Report Codes

(A) Section of System

[ ] 000 TRANSMISSION SYSTEM
[ ] 010 DISTRIBUTION SUBSTATION AFFECTING TOTAL SUB
[ ] 015 DISTRIBUTION SUBSTATION AFFECTING PART OF CIRCUITS
[ ] 020 OVERHEAD DISTRIBUTION PRIMARY
[ ] 021 OVERHEAD DISTRIBUTION TRANSFORMER
[ ] 022 OVERHEAD DISTRIBUTION SECONDARY
[ ] 023 OVERHEAD DISTRIBUTION SERVICE
[ ] 030 UNDERGROUND DISTRIBUTION PRIMARY
[ ] 031 UNDERGROUND DISTRIBUTION TRANSFORMER
[ ] 032 UNDERGROUND DISTRIBUTION SECONDARY
[ ] 033 UNDERGROUND DISTRIBUTION SERVICE
[ ] 040 CUSTOMER'S FACILITIES/METER/EQUIPMENT
[ ] 070 STREET LIGHT

(B) Phase Interrupt

[ ] 400 NEUTRAL CONDUCTOR
[ ] 411 1 OF 1 PHASE WIRES
[ ] 412 1 OF 2 PHASE WIRES
[ ] 413 1 OF 3 PHASE WIRES
[ ] 422 2 OF 2 PHASE WIRES
[ ] 423 2 OF 3 PHASE WIRES
[ ] 433 3 OF 3 PHASE WIRES

(C) Weather Code

[ ] 00 MODERATE-FAIR OR OVERCAST, ABOVE FREEZING
[ ] 01 MODERATE-FAIR OR OVERCAST, BELOW FREEZING
[ ] 02 HIGH WINDS
[ ] 03 RAIN
[ ] 04 RAIN AND HIGH WINDS
[ ] 05 LIGHTNING
[ ] 07 SNOW
[ ] 08 SNOW AND HIGH WINDS
[ ] 09 SLEET OR HAIL
[ ] 10 SLEET OR HAIL AND HIGH WINDS
[ ] 11 ICE–FREEZING RAIN
[ ] 12 FOG–MIST
[ ] 13 FOG–FREEZING
[ ] 14 LIGHTNING AND SNOW
[ ] 15 LIGHTNING AND RAIN
[ ] 16 EXCESSIVE HEAT

(D) Trouble Cause

[ ] 0000 FOREIGN UTILITY
[ ] 0001 TRANSMISSION SYSTEM
[ ] 0002 SUBSTATION EQUIPMENT
[ ] 1010 OTHER
[ ] 1020 UNKNOWN
[ ] 1030 PREARRANGED/CUSTOMER REQUEST
[ ] 1035 INTENTIONAL TO CLEAR TROUBLE
[ ] 1040 OPERATING ERROR (OTHER/UNKNOWN)
[ ] 1041 OPERATING ERROR (P.O.)
[ ] 1050 TREES, PREVENTABLE BY NORMAL TRIMMING
[ ] 1060 TREE, NON-PREVENTABLE
[ ] 2020 MAJOR STORM OR DISASTER
[ ] 2030 LIGHTNING
[ ] 2040 ICE, SLEET, SNOW
[ ] 2050 WIND
[ ] 2070 FLOOD
[ ] 3010 VEHICLE ACCIDENT
[ ] 3020 AIRPLANE
[ ] 3029 SMALL BIRD

(D) Trouble Cause, cont.

[ ] 3030 ANIMAL (NON-BIRD)
[ ] 3031 EAGLE
[ ] 3032 HAWK-OSPREY
[ ] 3033 OWL
[ ] 3034 FALCON
[ ] 3035 WATERFOWL
[ ] 3036 CROW/MAGPIES/RAVENS
[ ] 3037 BIRD UNKNOWN SPECIES
[ ] 3038 BIRD NEST
[ ] 3040 CONSTRUCTION EQUIPMENT
[ ] 3050 OUTSIDE INDIVIDUAL (VANDALISM, GUNSHOT, ETC.)
[ ] 3060 FOREIGN OBJECT
[ ] 3061 BALLOON
[ ] 3070 UNDERGROUND DIG-IN
[ ] 3080 FIRE
[ ] 4010 DETERIORATION
[ ] 4020 CONTAMINATION
[ ] 4030 ELECTRIC OVERLOAD
[ ] 4040 ELECTRIC FAILURE-OTHER
[ ] 4045 POLE OR CROSSARM FIRE
[ ] 4050 MECHANICAL FAILURE
[ ] 4060 FAULTY INSTALLATION
[ ] 4070 IMPROPER EQUIPMENT OR SETTING
[ ] 4090 CUSTOMER EQUIPMENT

(E) Failed Part Codes

[ ] 0000 OTHER
[ ] 0001 TRANSMISSION-PART FAILED ON TRANSMISSION LINE
[ ] 0002 DISTRIBUTION SUBSTATION-HIGH SIDE
[ ] 0003 DISTRIBUTION SYSTEM SERVING DISTRIBUTION SUBSTATION
[ ] 0010 NONE
[ ] 0020 NUMEROUS – MAJOR STORM OR DISASTER
[ ] 0030 ANCHOR
[ ] 0040 ARESSTOR
[ ] 0050 BUS – PRIMARY
[ ] 0055 BUS – SECONDARY
[ ] 0060 CAPACITOR – SHUNT BANK
[ ] 0065 CAPACITOR – SERIES BANK
[ ] 0070 CUSTOMER EQUIPMENT
[ ] 0160 CROSSARM
[ ] 0175 DEAD-END CLAMP OR CRIMP - PRIMARY
[ ] 0188 GUY
[ ] 0200 JUMPER WIRE
[ ] 0210 METERING EQUIPMENT
[ ] 0290 PEDESTAL – METERING
[ ] 0300 POLE
[ ] 0310 PROTRACTOR, NETWORK
[ ] 0320 RECLOSER-LINE
[ ] 0330 REGULATOR-LINE
[ ] 0360 SECTIONALIZER
[ ] 0385 SPLICE-UNDERGROUND, PRIMARY
[ ] 0386 SPLICE-UNDERGROUND, SECONDARY
[ ] 0387 SPLICE-UNDERGROUND, SECONDARY, T-TAP
[ ] 0440 TAPS CABLE, UNDERGROUND, PRIMARY
[ ] 0450 TERMINATION-UNDERGROUND
[ ] 0460 TIE WIRE (WRAP-LOCK, ETC.)
[ ] 0600 VAULT
[ ] 1010 CONDUCTOR OVERHEAD DISTRIBUTION PRIMARY
[ ] 1020 CONDUCTOR OVERHEAD DISTRIBUTION SECONDARY
[ ] 1030 CONDUCTOR OVERHEAD DISTRIBUTION SERVICE

(E) Failed Part Codes

[ ] 1040 CONDUCTOR UNDERGROUND DISTRIBUTION PRIMARY
[ ] 1050 CONDUCTOR UNDERGROUND DISTRIBUTION SECONDARY
[ ] 1060 CONDUCTOR UNDERGROUND DISTRIBUTION SERVICE
[ ] 1070 SHIELD/STATIC WIRE
[ ] 1110 CONNECTOR
[ ] 1210 CUTOUT
[ ] 1310 FUSE
[ ] 1410 INSULATOR
[ ] 1510 SPLICE
[ ] 1610 SWITCH
[ ] 1710 TRANSFORMER OVERHEAD DISTRIBUTION
[ ] 1711 TRANSFORMER UNDERGROUND DISTRIBUTION
[ ] 1712 TRANSFORMER OTHER
[ ] 7003 BUSHINGS
[ ] 7009 CONTACTS – STATIONARY
[ ] 7012 CONTROL – PROTECTION
[ ] 7013 FUSE
[ ] 7015 INSULATORS
[ ] 7016 MECHANISM
[ ] 7023 TAP CHANGER – LTC
[ ] 7024 WINDINGS
[ ] 7025 OTHER/UNKNOWN
[ ] 7026 RELAY FAILURE

(F) Protective Device

[ ] 000 OTHER
[ ] 010 BURIED CLEAR AT FAULT OR SEPARATED
[ ] 011 CLEARED MANUALLY – NO PROTECTIVE DEVICE OPERATED
[ ] 012 SCHEDULED INTERRUPTION
[ ] 025 TRANSFORMER FUSE BLEW
[ ] 026 TRANSFORMER SECONDARY BREAKER OPENED
[ ] 030 LINE FUSE BLEW
[ ] 031 LINE SECTIONALIZER/RECLOSER LOCK-OUT
[ ] 033 CIRCUIT (FEEDER) BREAKER LOCK-OUT
[ ] 040 SUBSTATION BANK PROTECTION OPENED
[ ] 050 TRANSMISSION LINE PROTECTION OPENED
[ ] 060 UNDERGROUND NETWORK PROTECTOR OPENED
[ ] 062 UNDERGROUND SWITCHGEAR OPENED (I.E. PADMOUNT VAULT)

(G) Restoration Method

[ ] 00 NORMAL SERVICE RESTORED
[ ] 01 CLEAN BRUSHING(S), INSULATOR(S), REFUSED
[ ] 03 COLD LOAD PICK-UP
[ ] 04 CUSTOMER EQUIPMENT R/R, REFUSED
[ ] 05 EQUIPMENT OR SETTING CORRECTED
[ ] 08 PATROL, REFUSED/RESET
[ ] 11 REMOVED FOREIGN OBJECT, REFUSED
[ ] 12 REMOVED ANIMAL OR BIRD, REFUSED
[ ] 51 RESAG, RETIE, REFUSED
[ ] 53 SECTIONALIZE
[ ] 54 SERVICE TERMINATED
[ ] 56 SUBSTATION R/R COMPLETE
[ ] 57 TRANSMISSION RESTORED
[ ] 59 TRIM TREES, REPAIR, REFUSED/RESET
[ ] 60 TEMPORARY FACILITIES INSTALLED
[ ] 61 BY-PASS DAMAGED EQUIPMENT
[ ] 62 REPLACED ARRESTOR
[ ] 70 REPAIR/REPLACE DAMAGED FACILITIES

CONTACT ENVIRONMENTAL SERVICES FOR ASSISTANCE ON APPROPRIATE USE OF THESE DESIGNS: Monte Garrett (Portland, 503-813-6629) or Jim Burruss (Salt Lake City, 801-220-2535).

MODIFICATION	PAGE
Transformer Connection Insulation	2
Jumper Wire Insulation – 12.5 kV	3
Insulated Jumper Wire > 12.5 kV	4
Pole-Top Extenders for Elevating Center Conductor	5
Insulator/Conductor Covers	6
Triangles to Prevent Bird Perching	7
Triangles with Overhead Perch	8
Perch, Bird, Pole Mounting	9
Markers to Increase Wire Visibility	10
Spiral Vibration Dampener	11
Aerial Marker Ball	12
Nest Platform on Structure	13
Nest Platform on Separate Pole	14

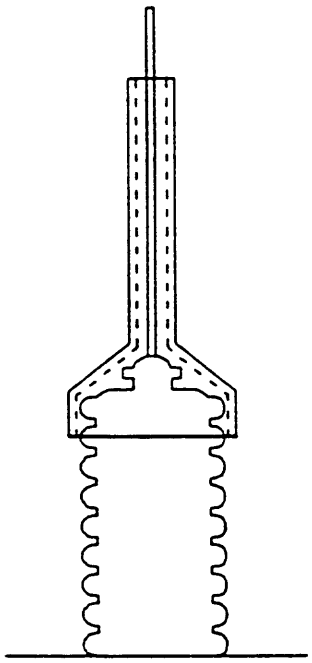
The following items can be ordered when needed for bird protection on power lines. Aerial marker balls, bird flight diverters, and raptor guards may not be kept in stock, but are available on short notice from the manufacturer. All other items are available from either the Pacific Division or Utah Division Materials Management Department. Costs may change without notice. Please check with Material Management for most recent unit cost.

GUARD, BIRD, EQUIPMENT BUSHING

This item is used in standard(s): EV921

UOM: **EA**

SIZE	RCMS_$	MANUFACTURER	STOCK NO.
3" X 3" X ½"	$3.29	Preformed Line Products Co. Line hardware Mfg. Co.	6438105*



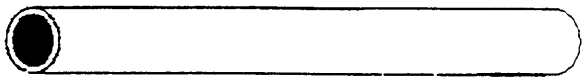
* Indicates items stocked in 0150 and 9011 warehouses.

JUMPER WIRE INSULATION (hose)

This item is used in standard(s): EV921

UOM: **FT**

SIZE	RCMS_$	MANUFACTURER	STOCK NO.
0.50"ID X 0.675"OD	$0.19	Davidson Plastics Empire Rubber & Supply Co. Inc. Goodyear Rubber & Supply Co.	6440408*



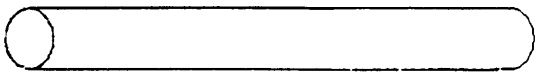
* Indicates items stocked in 0150 and 9011 warehouses.

CONDUCTOR, COPPER (insulated wire)

This item is used in standard(s): DG501, EC951, FP161

UOM: **FT**

SIZE, CONSTRUCTION, COVER, TYPE	RCMS_$	MANUFACTURERS	STOCK NO.
#6, SOL, Insulated, soft drawn, 5kV, (2500-ft reels)	$0.33	Perelli Cable Corp.	4121000*
		Allied Tube & Conduit	
		Southwire Company	
		The Okonite Company	
		General Cable Company	



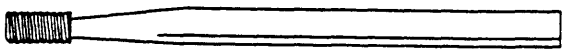
* Indicates items stocked in 0150 and 9011 warehouses.

PIN, POLE TOP

This item is used in standard(s): EF631

UOM: **EA**

LENGTH, THREADS, HOLES	RCMS_$	MANUFACTURER	STOCK NO.
20"L, 1" Nylon thd, 3Hole	3.44	Joslyn Manufacturing Co.	6448104*

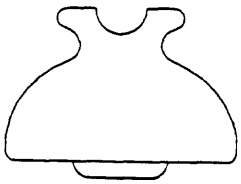


INSULATOR, PIN, 1" PIN, PORCELAIN

This item is used in standard(s): EF291

UOM: **EA**

VOLTAGE, NECK, CLASS	RCMS_$	MANUFACTURER	STOCK NO.
15kV, F-NECK, ANSI CL 55-4	$2.96	Cooper Power Systems Porcelain Products Co. Victor	5804406*
25kV, F-NECK, ANSI CL 55-5	$4.95	Cooper Power Systems Porcelain Products Co. Victor	5804505*
35kV, J-NECK, ANSI CL 55-6	$8.58	Cooper Power Systems Porcelain Products Co. Victor A.B. Chance Company McMaster-Carr	5805502*



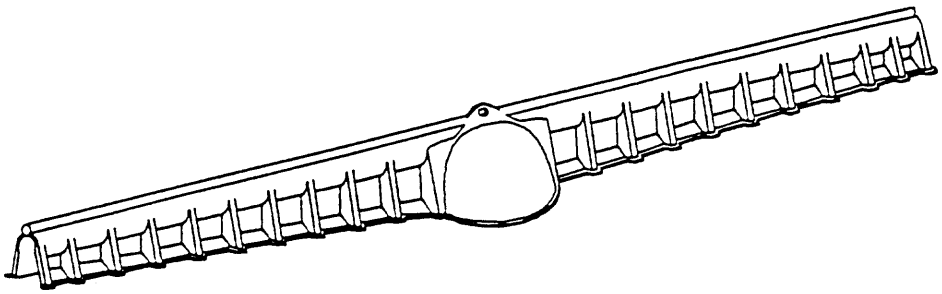
* Indicates items stocked in 0150 and 9011 warehouses.

GUARD, BIRD, CONDUCTOR/INSULATOR (plastic)

This item is used in standard(s): EV961

UOM: **EA**

VOLTAGE, CONDUCTOR SIZE	RCMS_$	MANUFACTURER	STOCK NO.
15kV, #6-250 KCMIL	$72.80	Kaddas Enterprises	1650130
15kV, 336-795 KCMIL		Kaddas Enterprises	1002849
25-35kV, #6-250 MCM	$100	Kaddas Enterprises	1002847
25-35kV, 336-795 MCM		Kaddas Enterprises	1002848

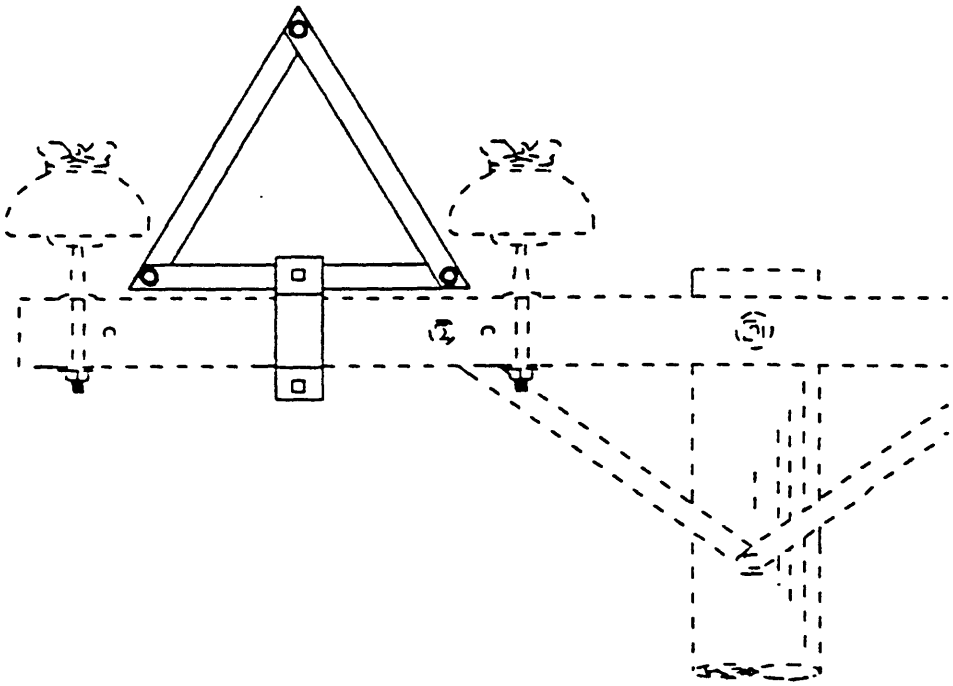


GUARD, BIRD, ARM MOUNTED

This item is used in standard(s): EV941

UOM: **EA**

CROSSARM SIZE	RCMS_$	MANUFACTURER	STOCK NO.
3-3/4" X 4-3/4"	$40.13	Riter Engineering Co.	5370605
		Hughes Brothers Inc.	
	$23.00	BR&W	
5-34" X 5-3/4"	$46.04	Riter Engineering Co.	5370608
4" X 5" with snap-on spring base, PVC[1]	$29.99	Pacer Industries, Inc.	4900215



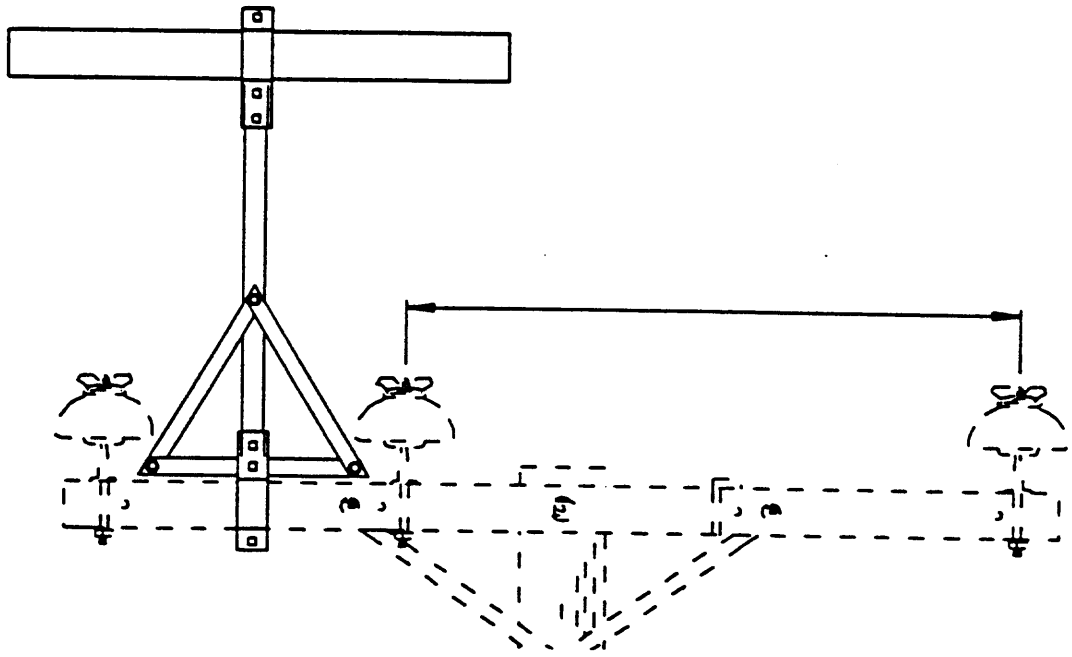
[1]This model of raptor guard is easier to install with a hot stick on crossarm; standard model fits 4"x5" crossarm and 18" triangle base, but may be built to fit all sized crossarms; contact Materials Management.

PERCH, BIRD, ARM MOUNTING

This item is used in standard(s): EV111

UOM: **EA**

CROSSARM SIZE	RCMS_$	MANUFACTURER	STOCK NO.
3.75" X 4.75" X-arm	$88.75	Hughes Brothers Inc.	1650100
	$27.00	BR&W	
3.75" X 5.75" X-arm	$105.97	Hughes Brothers Inc.	1650105
5.75" X 5.75" X-arm	$87.69	Hughes Brothers Inc.	1650110*

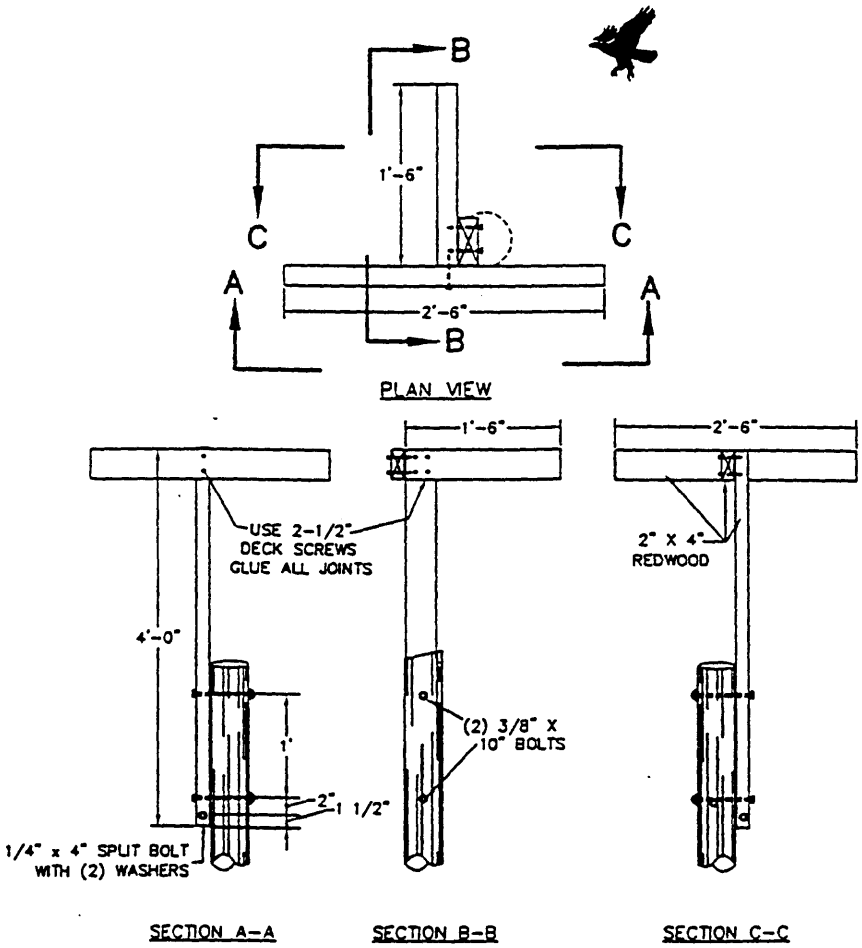


* Indicates items stocked in 0150 and 9011 warehouses.

This item is used in standard(s): EV101

UOM: **EA**

SIZE	RCMS $	MANUFACTURER	STOCK NO.
	$36.00	(field manufactured-see EV101 standards for parts)	1650120



NOTES:

1. CUT (1) EIGHT FOOT REDWOOD 2"X4" INTO THE THREE LENGTHS NOTED IN THE DRAWING ABOVE. ASSEMBLE GLUE AND SECURE ALL JOINTS WITH 2/1/2" DECK SCREWS.

2. USE (1) 1/4" X 4" SPLIT BOLT WITH (2) WASHERS 1-1/2" FROM BOTTOM OF PERCH INSERTED THROUGH THE WIDE PART OF THE WOOD TO PREVENT SPLITTING.

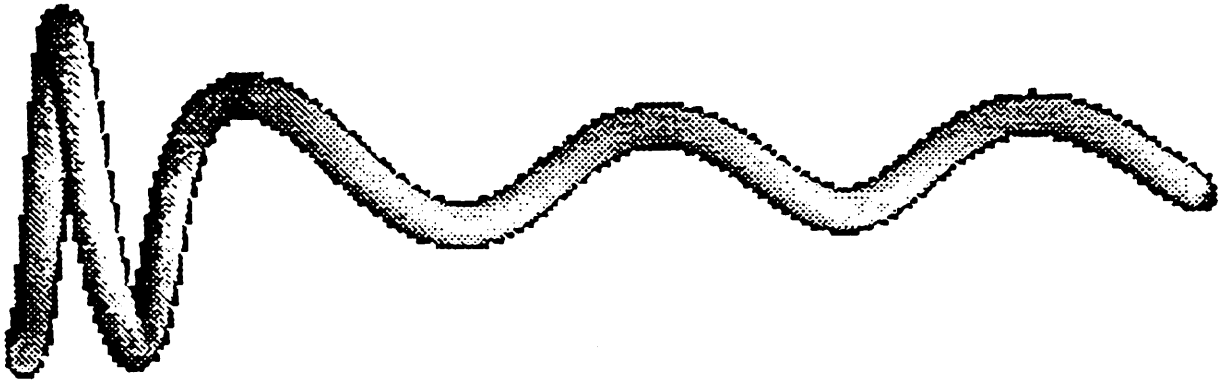
3. TWO (2) 3/8" X 10" OR LONGER CROSSARM BOLTS WITH WASHERS WILL BE USED TO ATTACH PERCH TO POLE.

GUARD, BIRD, FLIGHT DIVERTER

This item is used in standard(s): (PROPOSED BUT NOT IN STANDARDS YET)

UOM: **EA**

OD conductor sizes, Color	RCMS_$	MANUFACTURER	STOCK NO.
0.175" – 0.249", gray*	$5.59	Dulmision	1010208
0.250" – 0.349", gray*	$5.59	Dulmision	1010209
0.350" – 0.449", gray*	$5.59	Dulmision	1010210
0.450" – 0.599", gray*	$5.59	Dulmision	1010211



* Also available in yellow.

This item is used in standard(s): EF491, TD262

UOM: **EA**

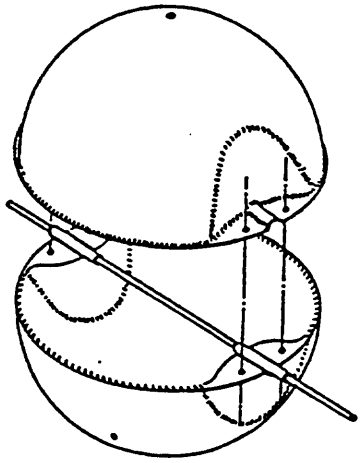
Diameter, Conductor size	RCMS_$	MANUFACTURER	STOCK NO.
0.250" – 0.326", #4-#2	$2.51	Dulmision, Inc.	4915203*
0.250" – 0.326", #4-#2	$2.51	Preformed Line Products	4915203*
0.327" – 0.461", 1/0	$2.77	Dulmision, Inc.	4915609*
0.327" – 0.461", 1/0	$2.77	Preformed Line Products	4915609*
0.462" – 0.563", 4/2-2/0	$3.27	Dulmision, Inc.	4915401
0.462" – 0.563", 4/2-2/0	$3.27	Preformed Line Products	4915401
0.564" – 0.760", 336AAC	$6.57	Dulmision, Inc.	4915500*
0.564" – 0.760", 336AAC	$6.57	Preformed Line Products	4915500*

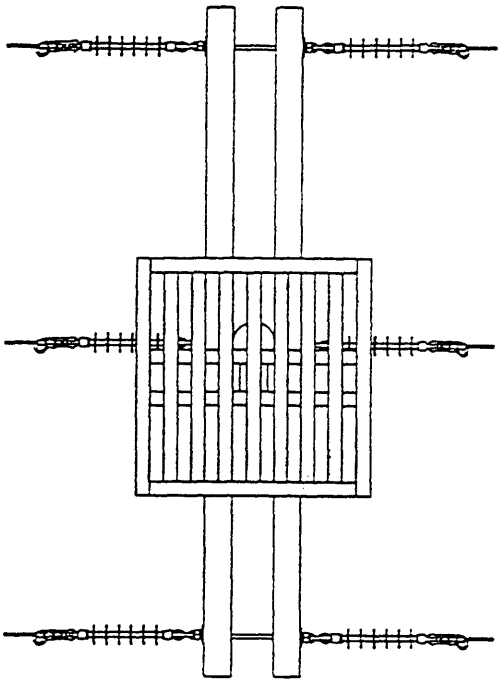
* Indicates items stocked in 0150 and 9011 warehouses.

This item is used in standard(s): (NOT LISTED IN STANDARDS)

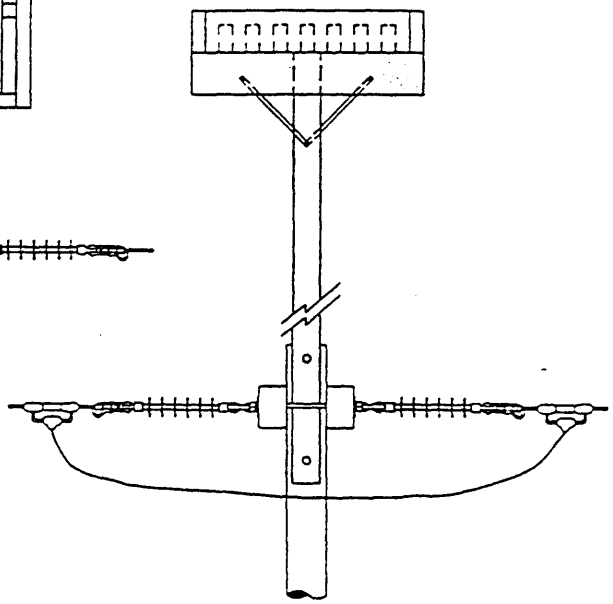
UOM: **EA**

SIZE, COLOR	RCMS_$	MANUFACTURER	STOCK NO.
9" diameter, Various wire sizes, Yellow w/black stripe	$50 (approx.)	Tana Wire Marker P.O Box 370 California, Missouri 65018 (314)796-3812	
9" diameter plastic, Various wire sizes, Orange or yellow		P&R Industries P.O. Box 554 Portland, OR 97207 (503)292-8682	

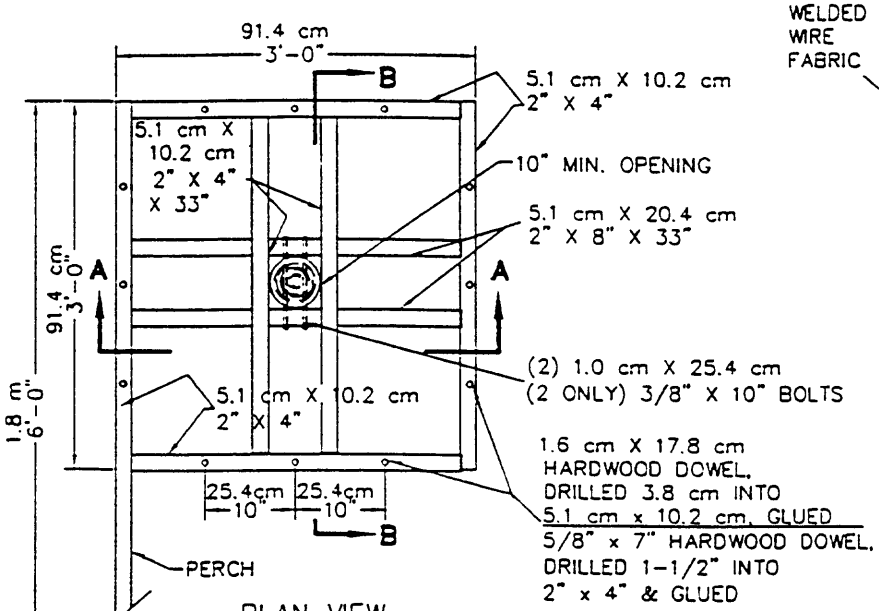




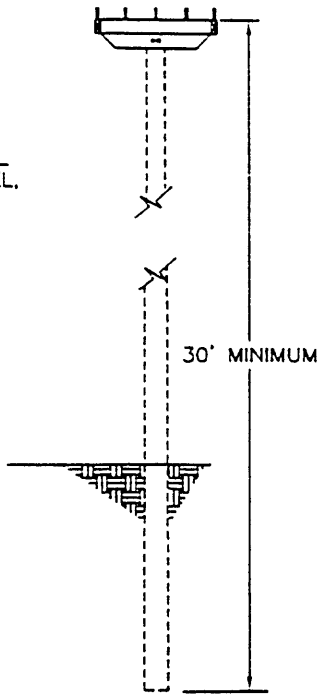
Top View



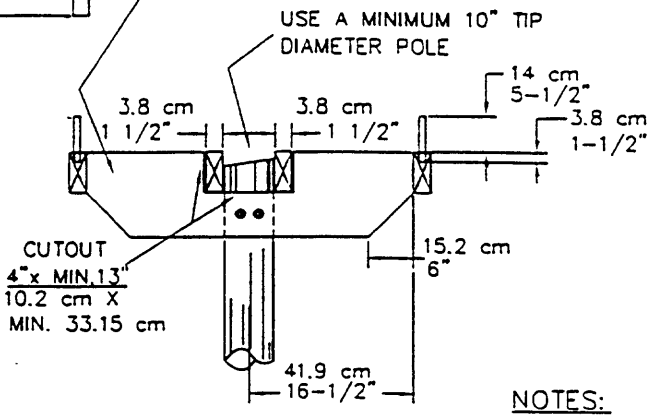
Side View



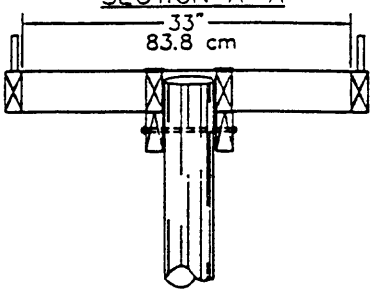
PLAN VIEW



ELEVATION



SECTION A-A



SECTION B-B

NOTES:

1. STAPLE A 91.4 cm X 91.4 cm (3' X 3') PIECE OF 1.3 cm X 5.7 cm (1-1/2" X 2") GALVANIZED WELDED WIRE FABRIC OVER THE TOP OF THE PLATFORM. CUT WIRE FABRIC TO FIT AROUND DOWELS.
2. PLATFORM MATERIAL SHALL BE REDWOOD AND ALL JOINTS AND DOWELS SHALL BE GLUED.
3. ATTACH WITH (2) 1.0 cm X 35.6 cm (3/8" X 14") BOLTS.
4. USE A MINIMUM 30 FOOT POLE. PLATFORM MUST BE SET HIGHER THAN ADJACENT LINES.
5. TRIANGULAR PERCH GUARDS MAY BE REQUIRED ON OLD STRUCTURE.

SPECIFICATION	PAGE
Single-Phase, Vertical Tangent, Pin Insulators	2
Single-Phase, Vertical, Angle with Dead Ends	3
Single-Phase, Vertical, Corner Structure	4
Single-Phase, Vertical, Dead-end Structure	5
Single-Phase, Crossarm, Dead-end Structure	6
Three-Phase, Tangent, Single Arm with Pin Insulators	7
Three-Phase, Angle, Single Arm with Post Insulators	8
Three-Phase, Angle, Double Arm with Post Insulators	9
Three-Phase, Angle, Double Arm and Dead-ends	10
Three-Phase, Vertical, Corner Structure	11
Three-Phase, Line Extension Assembly	12

CONTACT DISTRIBUTION ENGINEERING FOR ASSISTANCE ON APPROPRIATE USE AND APPLICATION OF THESE DESIGNS.

EH 101

May be used
in raptor areas

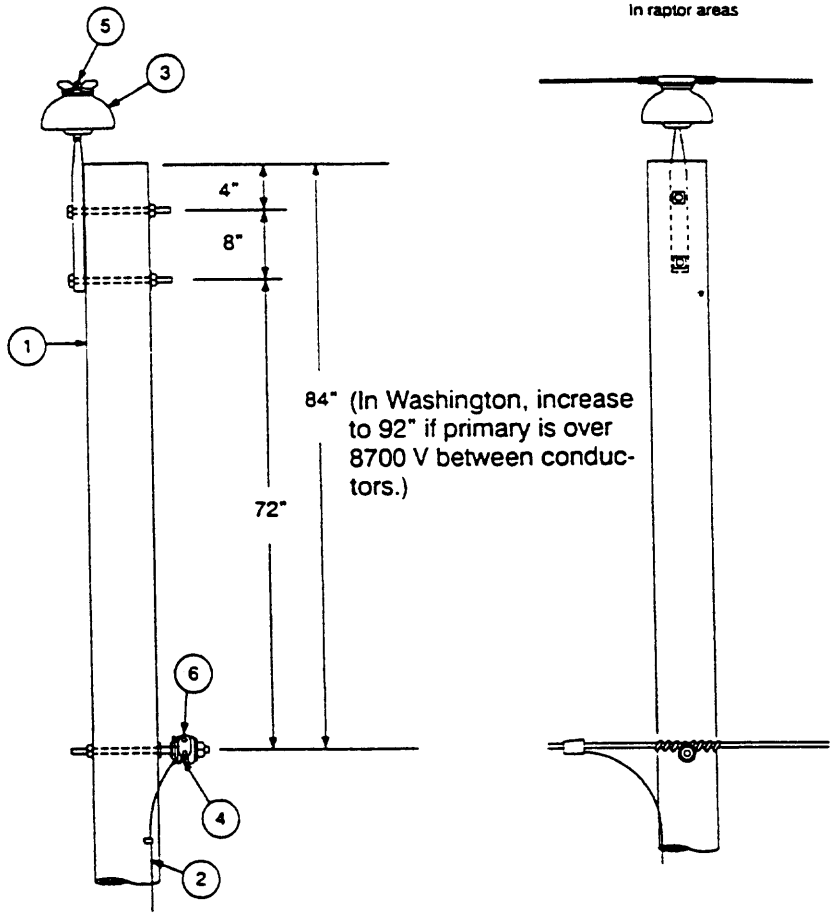
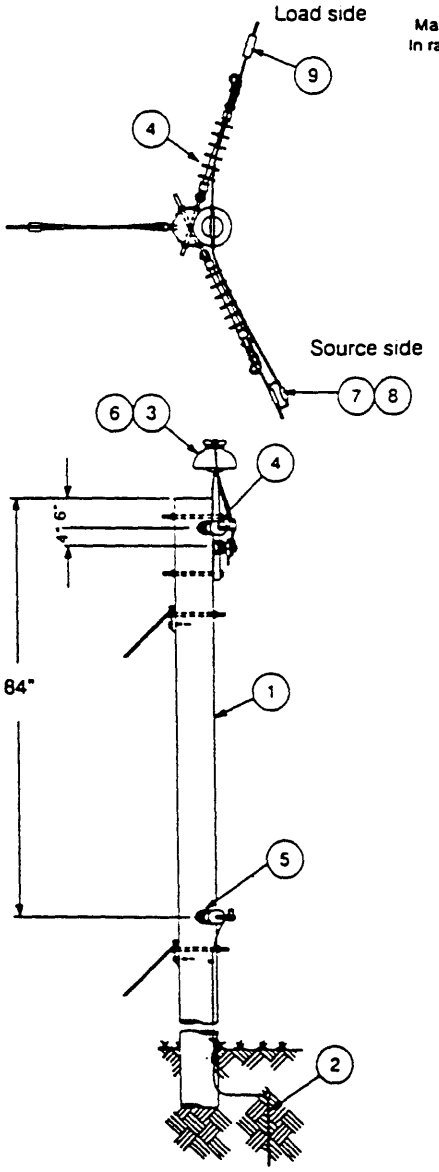


Figure 1 – Single-Phase Vertical Tangent Structure

EH 116

May be used in raptor areas



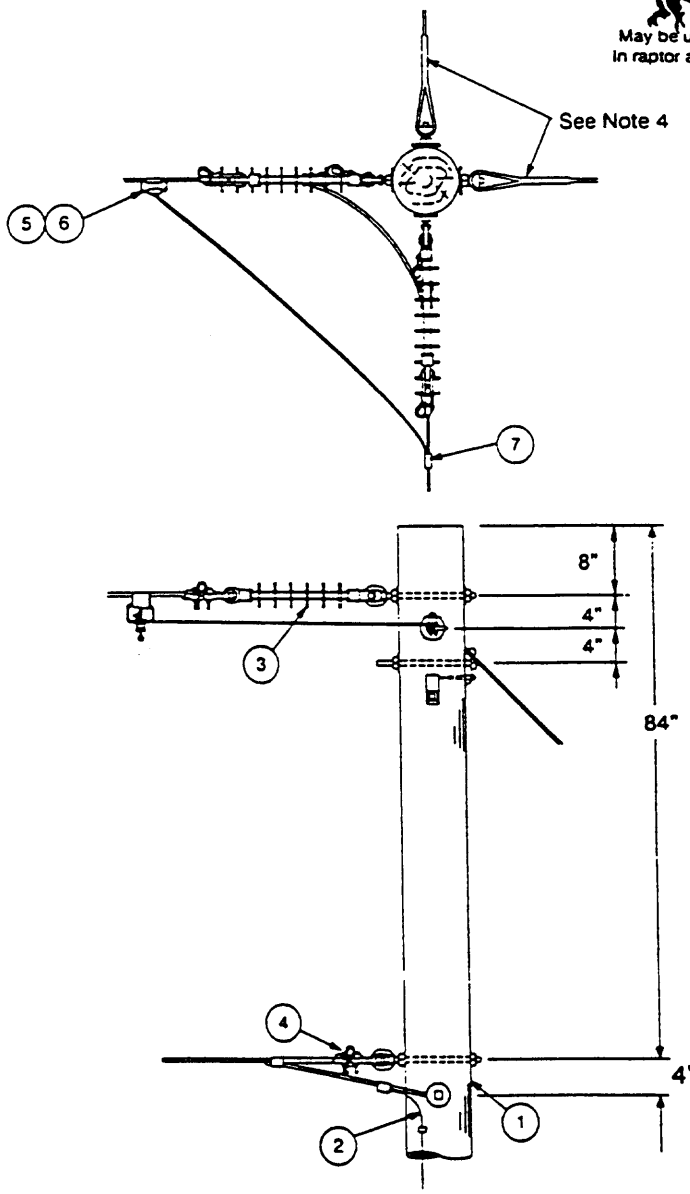
(In Washington, increase to 92" if primary is over 8700 V between conductors.)

Figure 1 – Single-Phase Vertical Dead-end Large-Angle Structure

Distribution Construction Standard	Single-Phase, Vertical Large-Angle Structure with Dead Ends	PACIFICORP PACIFIC POWER UTAH POWER
Engineer (N. Johnson): Distribution Engrg. (D. Hofman): Standards Services (M. Brimhall):		13 Jul 93 — EH 116 Page 3 of 3

EH 121

May be used in raptor areas



(In Washington, increase to 92" if primary is over 8700 V between conductors.)

Figure 1 – Single-Phase Vertical Corner Structure

Distribution Construction Standard	Single-Phase, Vertical Corner Structure	PACIFICORP PACIFIC POWER UTAH POWER
Engineer (N. Johnson): Distribution Engrg. (D. Hormann): Standards Services (M. Brimhall):		13 Jul 93 — EH 121 Page 3 of 3

EH 131

May be used
In raptor areas

Table 1 – Component Assemblies

No.	Standard	Description
1	EB 401	Pole, Wood
2	DG 201	Grounding Assembly, Rod
3	EF 181	Primary Dead-end Insulator Assembly, Pole
4	EF 181	Neutral Dead-end Assembly, Pole

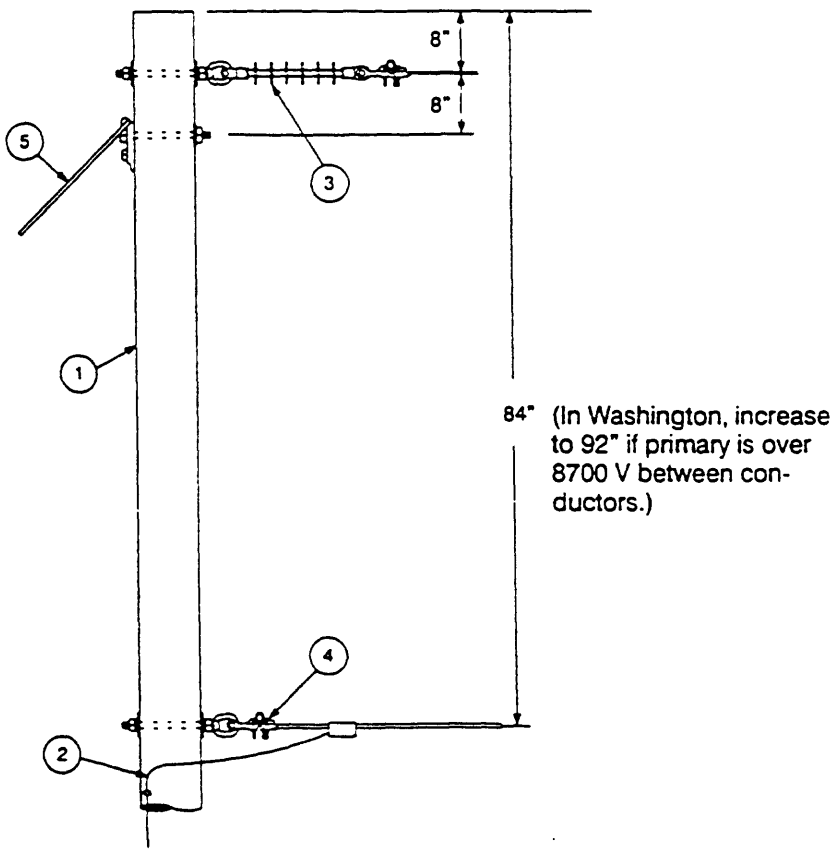


Figure 1 – Single-Phase Vertical Dead-end Structure

EH 341

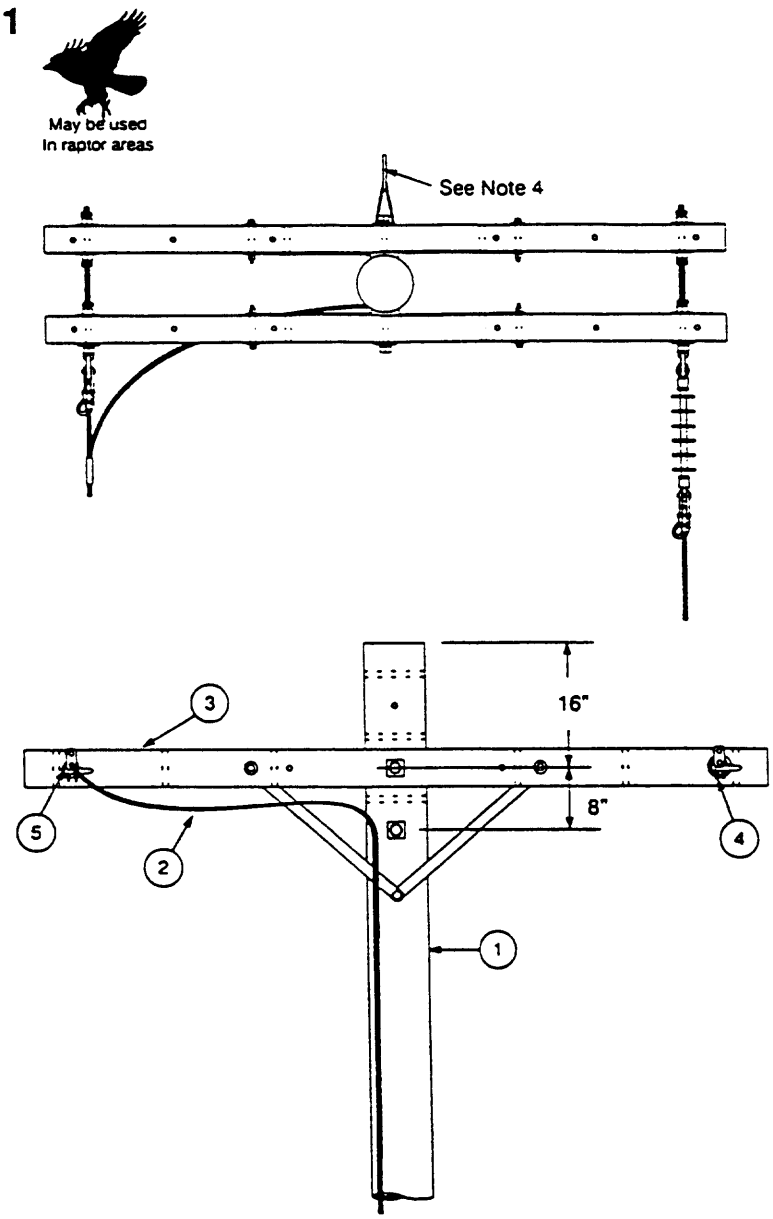


Figure 2 – Single-Phase Crossarm Dead-end Structure—Phase and Neutral

EJ 801

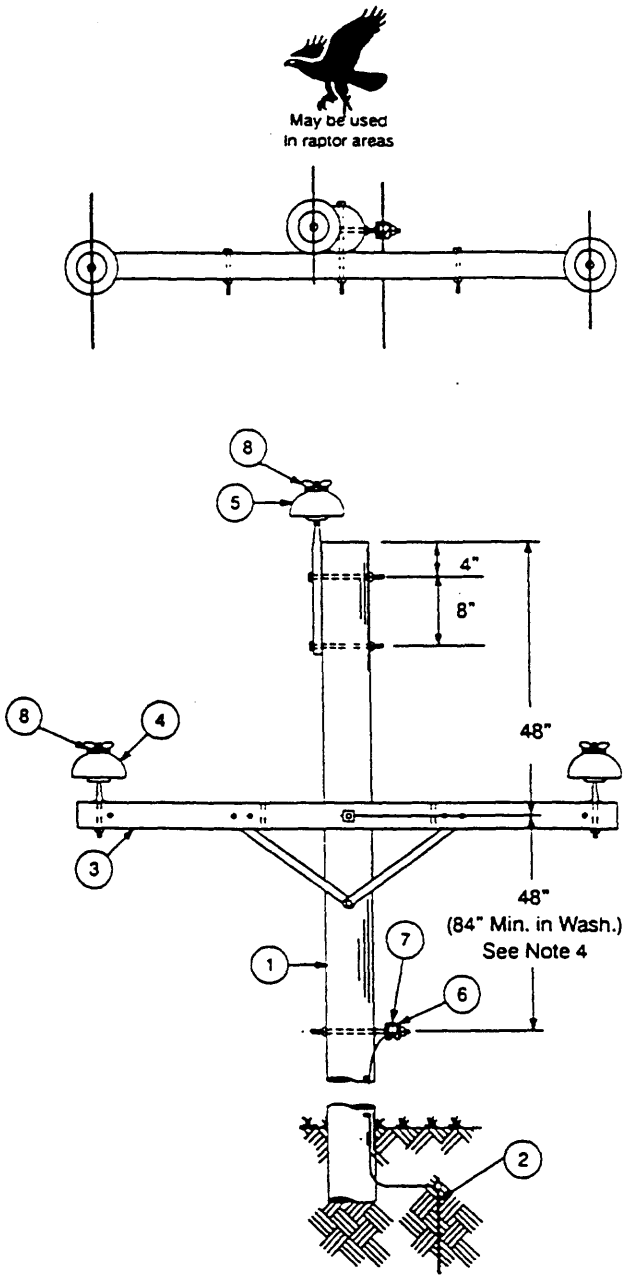


Figure 1 – Raptor-Area Single Arm and Pin Insulator Tangent Structure

Distribution Construction Standard	Three-Phase, Raptor-Area Tangent Structure Single Arm and Pin Insulators	PACIFICORP PACIFIC POWER UTAH POWER
Engineer (N. Johnson): Distribution Engrg. (D. Hofman): Standards Services (M. Brimhall):		14 Jul 93 — EJ 801 Page 3 of 3

EJ 811

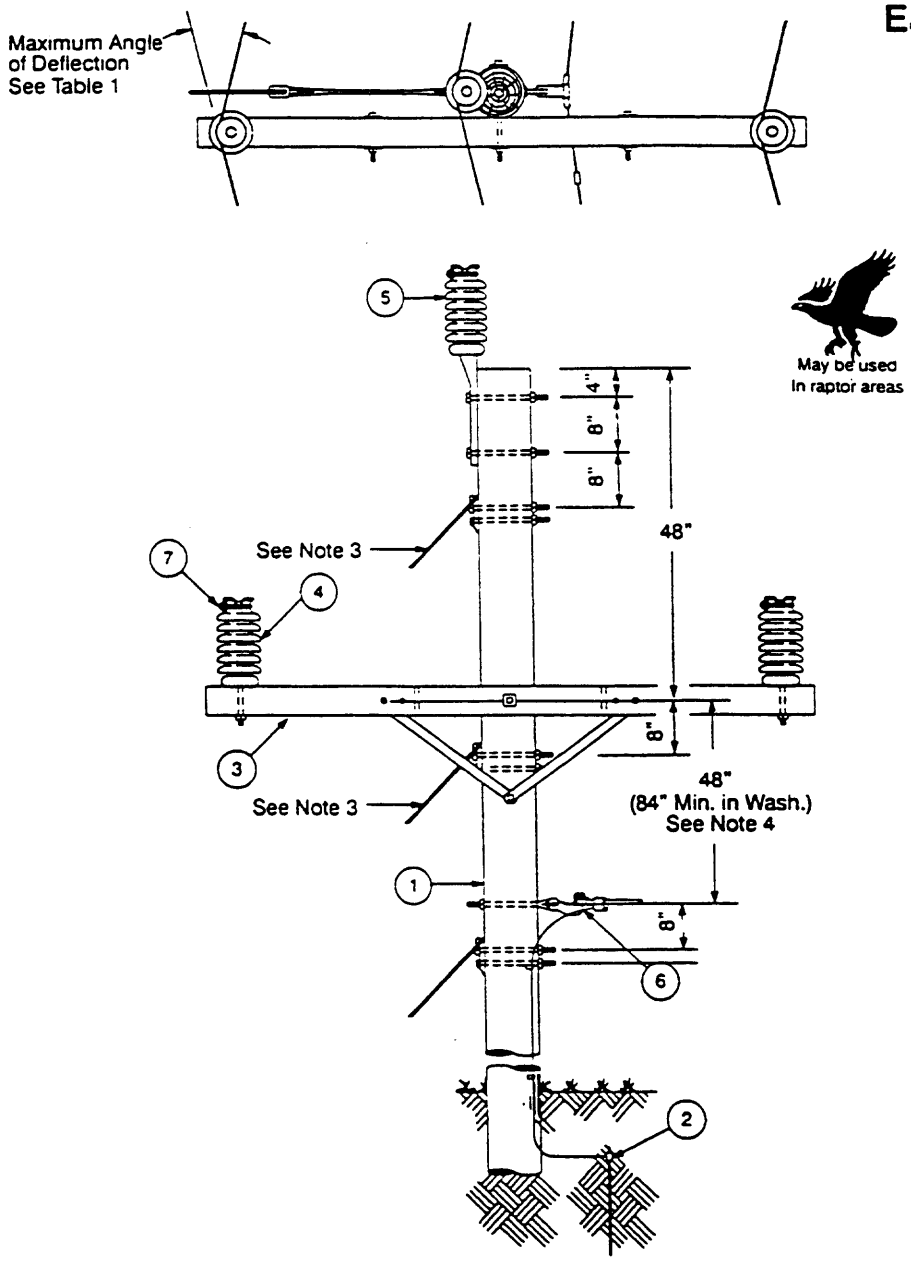


Figure 1 – Raptor-Area Single Arm and Post Insulator Angle Structure

Distribution Construction Standard	Three-Phase, Raptor-Area Angle Structure Single Arm and Post Insulators	PACIFICORP PACIFIC POWER UTAH POWER
Engineer (N. Johnson): NJ Distribution Engrg. (D. Hofman): DH Standards Services (M. Brimhall): MB		15 Jul 93 — EJ 811 Page 3 of 3

EJ 821

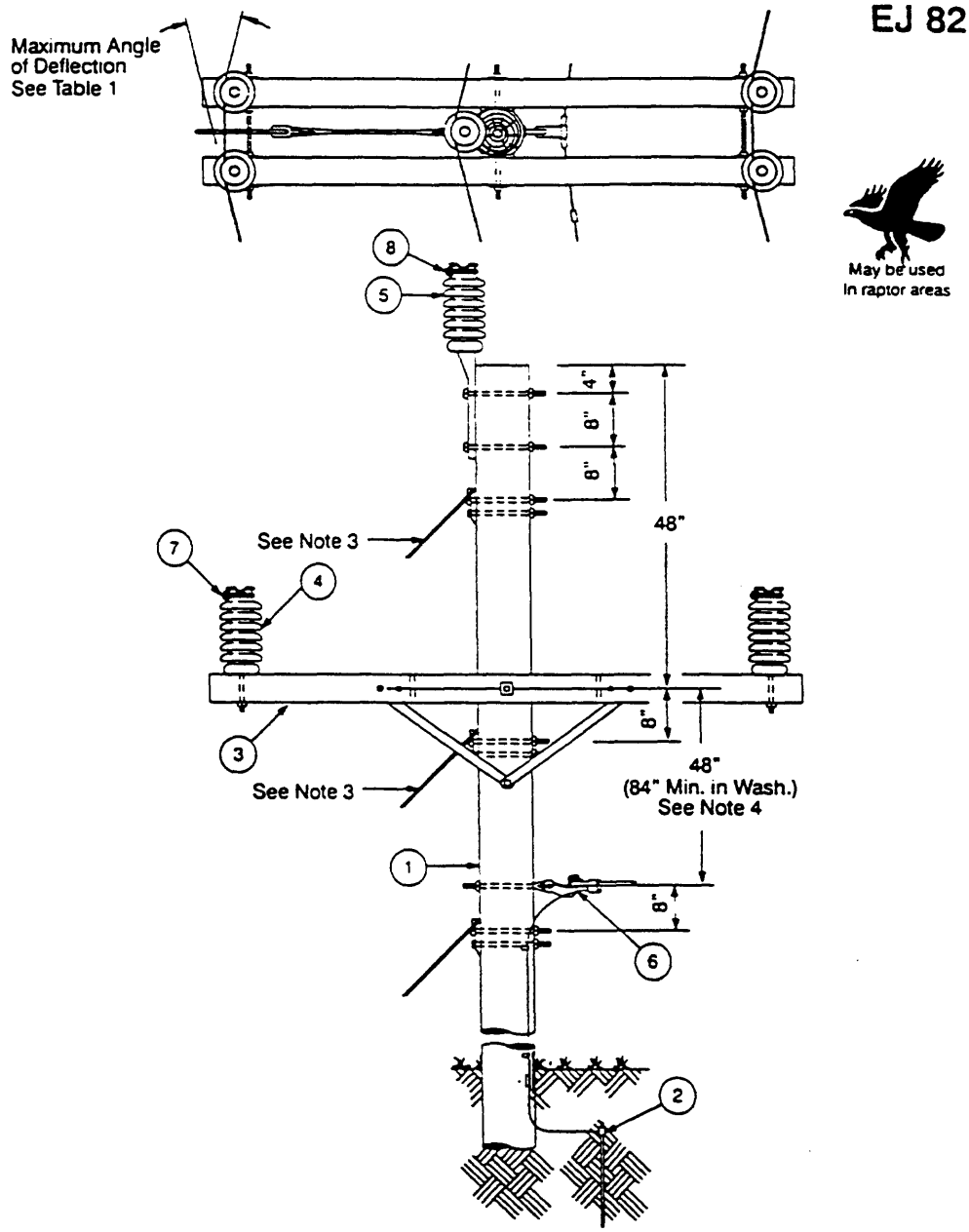


Figure 1 – Raptor-Area Double Arm and Post Insulator Angle Structure

EJ 831

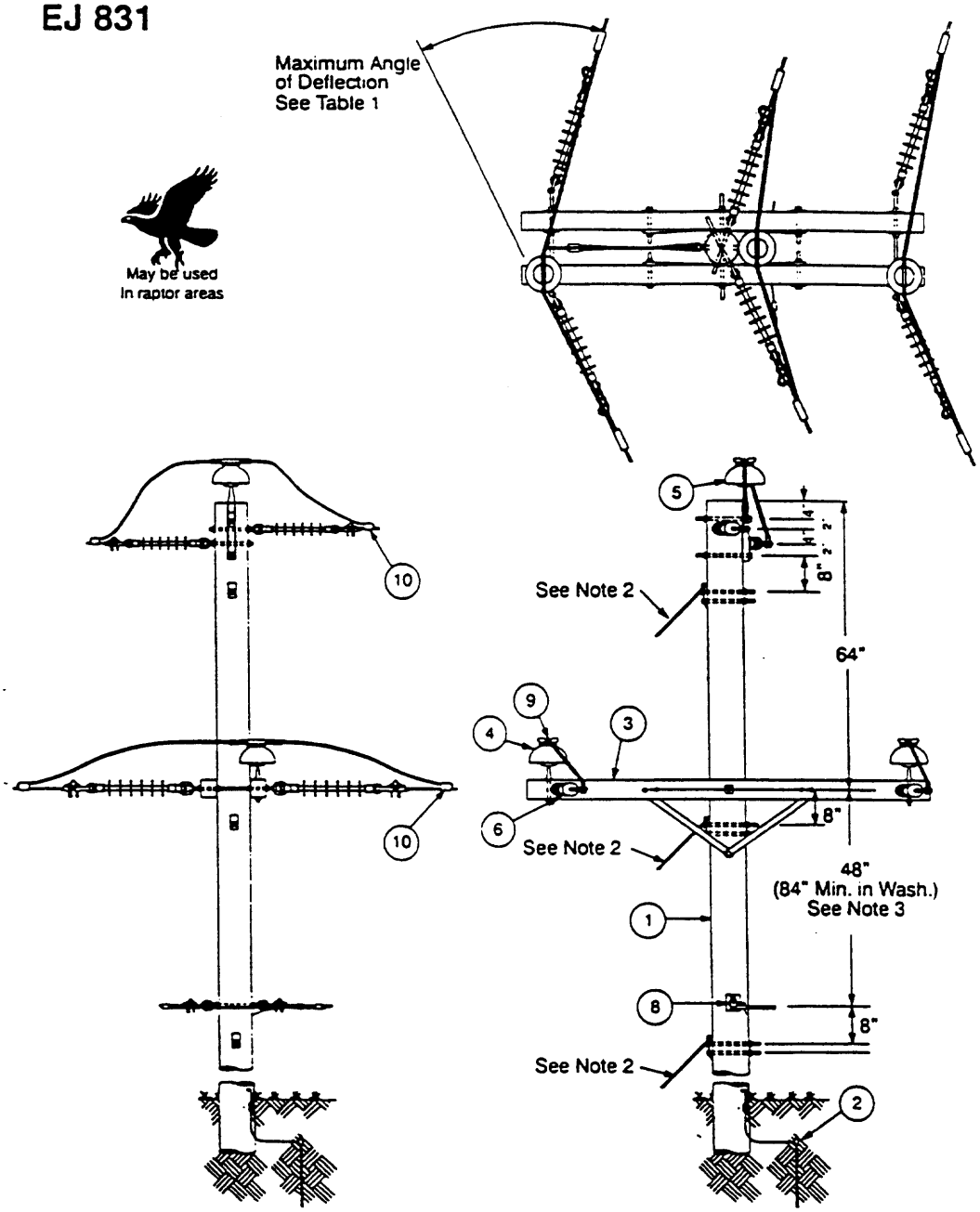


Figure 1 – Raptor-Area Double Arm with Dead-ends Angle Structure

EJ 841

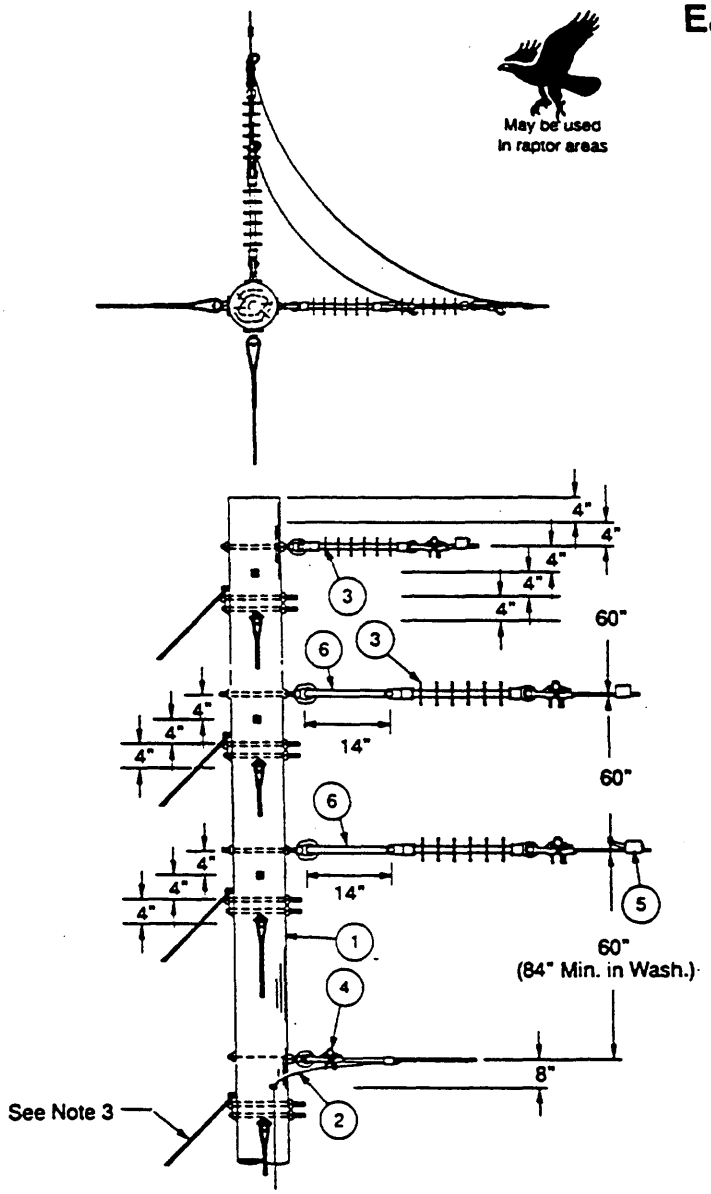


Figure 1 – Raptor Area Vertical Corner Structure

EJ 871

May be used
in raptor areas

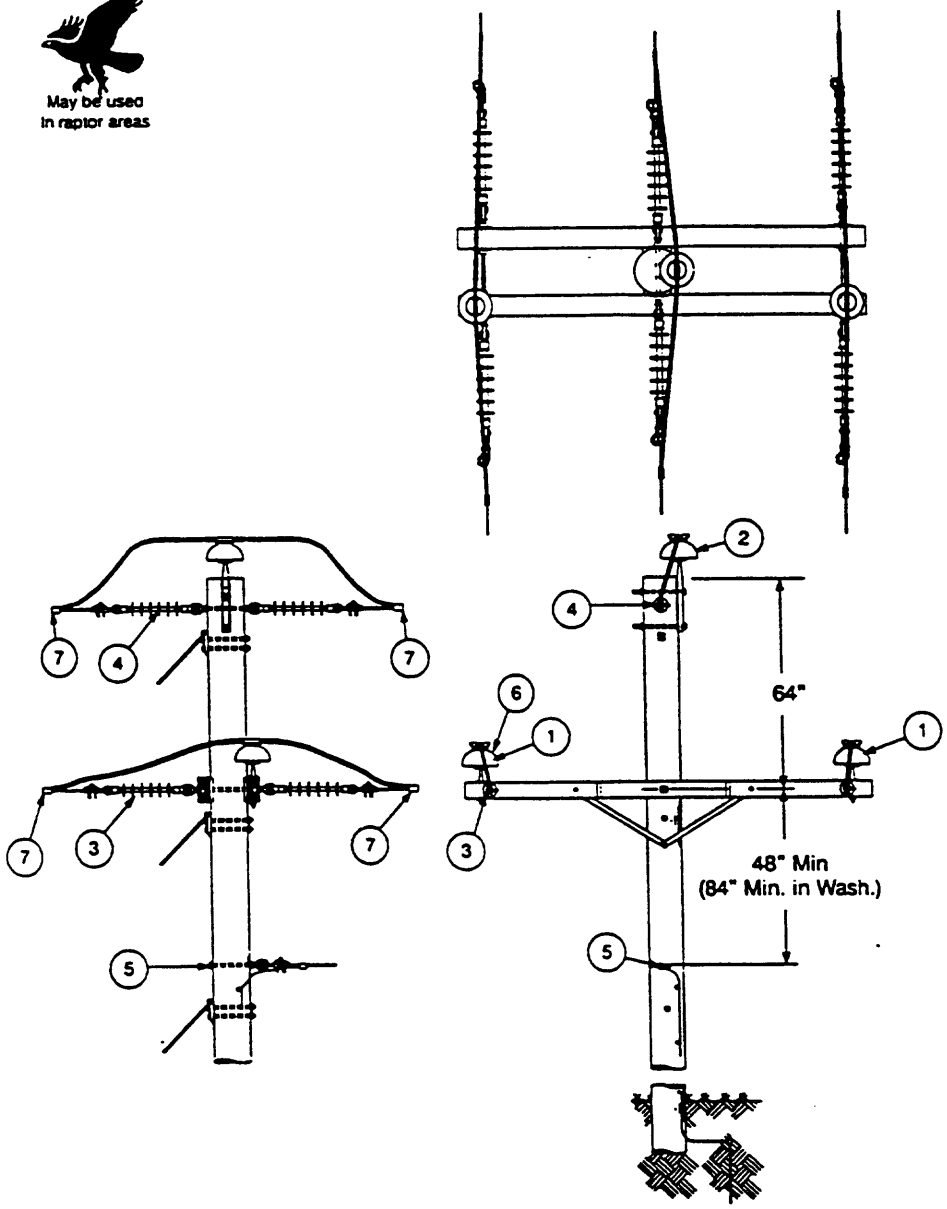


Figure 1 – Raptor-Area Line Extension Assembly

VOLUME 11, APPENDIX VOLUME - R645-301-400 LAND USE & AIR QUALITY: APPENDIX A

The Archeological Reports listed below are considered confidential documents and are not included with this permit application package. The reports are filed as "Confidential" at the Division of Oil, Gas, and Mining offices in Salt Lake City, Utah.

Senulis, J.A., September 30, 2003, An Intensive Cultural Resource Survey and Inventory of the Rilda Canyon Mine Site, SINCO-PHENIX, SPUT - 461.

Senulis, J.A., July 28, 2004, An Intensive Cultural Resource Survey and Inventory of the Rilda Canyon Mine Site, SINCO-PHENIX, SPUT - 477.

R645-301-500 ENGINEERING SECTION

APPENDIX A

♦GROUND STABILITY ANALYSIS: 4/5TH NORTH MAINS CROSSING OF THE RIGHT FORK OF RILDA CANYON

NOTE: Maps HM-10 and HM-11 Referenced in Appendix A Have Been Relocated to Volume 9

GROUND STABILITY ANALYSIS
4/5TH NORTH MAINS CROSSING OF THE RIGHT FORK OF RILDA CANYON

ENERGY WEST MINING COMPANY
NORTH RILDA AREA PERMIT APPLICATION
DEER CREEK MINE
(JULY 1997 - REVISED SEPTEMBER 1998)

RE: LONG TERM GROUND STABILITY ANALYSIS OF THE IMMEDIATE AREA OF THE PROPOSED INTERSECTION/UNDERGROUND CROSSING OF THE DEER CREEK MINE'S 4/5TH NORTH MAINS AND THE RIPARIAN ZONE WITHIN THE RIGHT FORK OF RILDA CANYON; FEDERAL LEASE U-06039.

INTRODUCTION:

A portion of the Right Fork of Rilda Canyon lies within the proposed North Rilda Area Permit Application of the Deer Creek Mine. Due to the environmental sensitivity of the Right Fork area (specifically the sub-surface hydrologic alluvial system and associated surface riparian vegetation zone), a complete analysis of a proposed "no subsidence / long term stability" design of the 4th/5th North Mains development within the area of the Right Fork of North Rilda Canyon has been prepared addressing the long term ground stability and subsidence protection of the area with regards to proposed mining. All pre-mining and post-mining conditions have been evaluated based on the best geologic and engineering information currently available (SEE ATTACHED ENCLOSURES - DEER CREEK MINE RIGHT FORK OF RILDA CANYON PROFILES AND CROSS SECTIONS; DRW.# DS1633D [HM-10] AND # DU1687E [HM-11]).

4/5TH NORTH MAINS (OVERVIEW):

The 4th North Mains, consist of a 5-entry development section, bearing northwest from the Deer Creek 10th West Mains. Initial location of the 10th West / 4th North intersection was based on the following:

(1) Existing Blind Canyon Seam conditions encountered with regard to 10th West Mains development
(2) Proximity to the projection of the Mill Fork Fault Graben
(3) Most practical access route to the North Rilda - Blind Canyon and Hiawatha coal reserves, across the North Rilda Forks area.

A complete analysis, with regard to location and long term ground stability of the 4th North/10th West Mains and the Left Fork of Rilda Canyon was conducted and submitted by PacifiCorp to the BLM on November 15, 1996. Approval to proceed with relocation and

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development of the 4th North Mains was given by the BLM (per letter) February 13, 1997.

With regard to PacifiCorp's North Rilda Area Permit Application, the 4th North Mains were originally projected to be developed northwest (approximately 3000 feet), from the 4th North / 10th West Mains intersection. The mainline development, designated as 5th North, then changed course to a northeast bearing, with development proceeding under the Right Fork area of Rilda Canyon. Selection of the Right Fork stream crossing area was based on the results of an extensive surface exploration program conducted in the Right Fork of Rilda Canyon (refer to maps HM-9, HM-10 and HM-11). A series of six drill holes were completed in 1997 to document coal seam characteristics, structural geology and hydrologic conditions. Drilling was conducted on approximately 250 foot centers across the projected Mill Fork Graben from previously completed drill holes EM-158 and EM-56. No structural discontinuities were identified during drilling. Groundwater encountered during drilling was restricted to minor quantities from the alluvium/colluvial fill (estimated at 2 - 5 GPM) near the bedrock interface. Based on the results of the 1997 surface exploration conducted in the Right Fork of Rilda Canyon, a meeting was held in October 1997 with DOGM, USFS, and BLM to discuss the re-location of the 4/5th North intersection to maximize the overburden in the Right Fork stream crossing. The 5th North Mains were re-located approximately 800 feet west of the original projection, increasing the overburden from 120 to approximately 200 feet. In reviewing the exploration data and in-mine information from the development of the 5th North Mains, it appears that the eastern fault of the Mill Fork Graben diminishes to the south from where it was intercepted in the Beaver Creek No. 4 Mine located north of Mill Fork Canyon. If mining intersects faulting related to the Mill Fork Graben during development, permanent seals will be installed to control groundwater if present.

Based on the information gained from the surface exploration drilling , a detailed plan was developed to reposition the 4th North / 5th North intersection. This plan optimized the "no subsidence-/ long term stability" design for the 5th North / Rilda Canyon Right Fork crossing route and rock slope access into the lower Hiawatha Seam as well as maximizes the overall reserve recovery within the area.

RIPARIAN ZONE - RIGHT FORK OF RILDA CANYON

The riparian zone within the Right Fork of Rilda Canyon (as shown on the above referenced enclosures) was delineated by field observation, aerial photography, and map contour analysis. The extent of the identified zone is based on the contact of the alluvial fill with the canyon's side slopes. The alluvial/colluvial fill contacts were inferred from existing map contours where rapid changes in slope gradient were assumed to indicate a material composition change. The alluvial/colluvial fill contact was assumed to occur where these grade changes occurred.

The riparian zone (as mapped) also includes an agency requested "buffer zone". This "buffer zone" is calculated from the lower Hiawatha seam's horizon/elevation @ 15 degrees to a point of intersection on the surface. The "buffer zone" delineates an area restricted from full extraction second mining.

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This referenced 15 degree "angle-of-draw" / "angle-of-influence" is an industry/agency accepted standard used for delineation of surface influence protection from mining areas considered for full-extraction mining. Mining experience at Energy West's Deer Creek, Cottonwood, and Trail Mountain mines has provided a sound, scientific basis for using the 15° angle of draw mentioned above. The angle of draw of subsidence produced by full-extraction mining can be influenced by many factors. These include the size of the area mined, number of seams mined, fractures or faults in the overburden, adjacent mine workings, and adjacent areas of burned coal and clinker. If mine workings extend to an area of burned coal, experience has shown that the overburden stresses above the mined area can be transferred to the adjacent burned coal and clinkers which can cause the clinkered areas to fail. In this case, the angle of draw may appear to be very shallow, when the crushing of the clinkered areas are the source of subsidence outside the normal area of influence.

Faults can also influence the angle of draw. If mining occurs adjacent to an existing fault, the area of subsidence will follow the natural plane of weakness formed by the fault. In this case, the angle of draw will be the same as the dip of the fault.

Based on data collected by the U.S. Bureau of Mines and eighteen years of subsidence data collection on East and Trail mountains, the angle of draw is found to be between 0 and 15 degrees from vertical. In some limited areas, the angle of draw is greater than 15 degrees, but in every case, the angle is greater due to the influence of one of the other factors mentioned above.

For planning purposes, any barrier of protection left in the mine to protect surface features should use a 15 degree angle of draw unless one of the factors mentioned above is known to exist in the immediate area.

All mining considered within the Forks area of Rilda Canyon is proposed as "partial extraction"/"zero-subsidence" reserve recovery. Therefore, the buffer zone (as shown) only delineates how close second mining may be projected within the Rilda Canyon Fork area of Federal Lease U-06039.

5TH NORTH MAINS - DEER CREEK MINE

The 5th North Mains consist of a 5-entry mainline development section with standard support pillars on 80 ft. x 130 ft. centers. Standard overall entry height ranges from 7.0 - 8.5 feet. Standard overall entry width ranges from 18.0 - 22.0 feet. As discussed above, the 5th North Mains assume a northeast bearing across the intersection/crossing area of the Right Fork of Rilda Canyon within Federal Lease U-06039.

The immediate roof strata overlying the Blind Canyon coal seam, in the general area of the Deer Creek Mine's 5th North Mains/Right Fork crossing of Rilda Canyon, ranges from approximately 170 to 210 feet in total thickness and consists of interbedded sandstones /mudstones; massive

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sandstones, and alluvial/colluvial fill. Surface exploration drill holes EM-160 - EM-162 provides the best representative lithologic unit for this site specific area (See Attached Enclosures maps HM-10 and HM-11 for detailed information).

The proposed configuration of the 5th North Mains, throughout the area of the Right Fork of Rilda Canyon, is similar to the current configuration of the existing 10th West / 4th North Mains (within the Left Fork area of Rilda Canyon). Both canyon crossings are considered designed and protected for "**ZERO-SUBSIDENCE**" to insure the required long term (hundreds of years) stability and integrity of the underground openings with regard to limiting the potential of any future surface impact.

To insure long term stability of the 5th North Mains and afford further protection to the riparian zone throughout the effected area of 5th North Mains crossing of the Right Fork area, entry/pillar configuration will consist of a 5-entry development with staggered cross-cuts on 80ft. x 150 ft. pillar centers (See Attachment #1). Primary roof support throughout the immediate area will consist of standard 5 ft. resin grouted roof bolts on 5 ft. centers. Secondary roof support (as ground/roof conditions dictate) will consist of a combination of available materials (ie: point-anchor [active/grouted] roof bolts, steel bearing plates, wire mesh, steel roof mats, grouted cable bolts, "CAN" cribs, wooden cribs, etc.).

STABILITY ANALYSIS

To address the concerns with regard to the long term stability of the mine openings proposed within the Right Fork area of Rilda Canyon, pillar stability and beam theory analysis is presented within this report.

PILLAR STABILITY:

The long term stability of the proposed 80 ft. x 150 ft. support pillars (proposed within the riparian zone of the Right Fork crossing) were evaluated using the Tributary Area Analysis Method (See Attachment #2).

This analysis is very conservative because it assumes that an in-mine pillar will support **ALL** of the immediate overburden directly above it. Actual in-mine studies have indicated that a support pillar will only see a portion (60% - 70%) of the actual vertical overburden weight. The overburden cross-section, along the original projected bearing of the proposed 4th North Mains , prior to the re-location 800 feet to the west, (Section A - A'; See Map HM-11), details the immediate area of the alluvial/riparian zone of the Right Fork of Rilda Canyon. Overburden thickness varies from 648 ft. at the northeast margin to 99 ft. in the bottom of the Right Fork Canyon.

Pillar stress and safety factors were calculated at different locations along the development bearing using the Tributary Area Analysis method. The pillar compressive strengths used in the analysis are actual measured (in-mine) strength values, averaging approximately 4000 psi.

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Once pillar strength and pillar stress is known, a factor of safety is calculated. The factor of safety is calculated by dividing the pillar strength by the pillar stress. A factor of safety of 1.0 or greater indicates stability. A factor of safety of 1.5 - 2.0 (or greater) indicates long term stability. The calculated factors of safety along the projected bearing of the 4/5th North Mains range from 3.57 under the deepest cover to 23.94 in the canyon bottom. These factors of safety indicate long term stability for the 4/5th North Mains layout throughout the area of the crossing of the Right Fork of Rilda Canyon.

BEAM ANALYSIS:

To further address the long term stability of the mine openings within the Right Fork area of Rilda Canyon, beam theory analysis was also employed (See Attachment #3).

Beam theory suggests, that when an underground opening is excavated, the immediate roof strata acts as a beam to support the strata overlying the opening. If the beam is strong enough to support itself and the effected overlying strata, then the opening will be stable.

When an underground opening is excavated, the stress distribution in the surrounding rock mass changes. The support that the excavated material supplied to the surrounding rock mass is no longer there. The stress therefore, arches over the opening and redistributes itself to the surrounding rock. In underground excavations, it is an accepted value that the zone of influence of an opening is determined to be approximately two (2) times the opening height. In beam theory, when an underground opening is excavated, the strata overlying the mine opening acts as a beam to support the immediate roof, or the material within the opening's affected zone.

Beam stability is evaluated by calculating the assumed beam's factor of safety. The factor of safety is the tensile strength of the beam divided by the maximum tensile stress that the beam is subjected to. It is assumed that a factor of safety of 1.5 - 2.0 (or greater) represents long term stability. Based on the proposed layout of the 4th North Mains within the area of the Right Fork of Rilda Canyon (prior to the relocation 800 feet to the west), this factor of safety is calculated at approximately 4.92 (See Attachment #3); indicating long term stability of the assumed roof beam and thus the mine entries.

SUPPLEMENTAL SUBSIDENCE MONITORING

Prior to development mining below the riparian zone of the right fork of Rilda Canyon, permanent subsidence monitoring sites were established directly above the proposed mains to verify ground stability conditions. Location of the stations were determined based upon the final mine layout for the proposed crossing. Monitoring will be conducted on a quarterly basis during accesible periods until lease relinquishment or until an alternate schedule is approved by D.O.G.M. and surface land management agency (U.S.D.A. Forest Service).

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FINAL RETREAT - NORTH RILDA ABANDONMENT

Prior to final mine retreat and abandonment of the North Rilda Canyon Area , PacifiCorp will submit (for technical review and evaluation to the appropriate permitting management agencies) historical in-mine and surface stability data necessary to assess the long-term surface stability of the Right Fork area of Rilda Canyon. An on-site review will be conducted to evaluate long-term stability of the Right Fork of Rilda Canyon.

Based on the site specific technical data review and evaluation mentioned above, final design and implementation of any additional ground support necessary to prevent long-term surface subsidence within the affected area will be based on the "best technology currently available" at the time of abandonment.

CONCLUSION

The Right Fork of Rilda Canyon contains an important alluvial system which contributes to the overall flow of springs and flow to Rilda Creek within the immediate area of Rilda Canyon (Federal Lease U-06039). Interburden between the canyon's bottom and the proposed 5th North Mains development horizon (Blind Canyon Seam), is shallow and represents a potential concern to the long term stability of these entries with regard to possible damage to the alluvial system due to entry failure and surface subsidence.

As per the above discussion, both pillar stability and beam failure analysis demonstrates factors-of-safety far in excess of those required for long term stability. The proposed entries of the 5th North Mains within the Forks area of Rilda Canyon represent PacifiCorp's long term access to the North Rilda Canyon reserves within the Blind Canyon and Hiawatha Seams and are considered critical to Deer Creek Mine's future. Any potential ground/entry instability in this area is not acceptable from either an environmental or mining standpoint.

From the study/analysis presented, it is evaluated that the proposed "no subsidence / long term stability" design of the 5th North Mains (within the area of the Right Fork of North Rilda Canyon) demonstrates full protection to the alluvial/hydrologic system and riparian zone present and that the integrity and long term stability of the Right Fork Canyon is not compromised by the proposed underground development mining necessary to access the existing North Rilda coal reserves.

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CASTLEGATE ESCARPMENT
STATEMENT OF MINING IN THE NORTH RILDA AREA
AREA OF FEDERAL LEASE U-06039

ENERGY WEST MINING COMPANY
NORTH RILDA AREA PERMIT APPLICATION
DEER CREEK MINE
(JULY 1997 - REVISED SEPTEMBER 1998)

RE: CLARIFICATION STATEMENT REGARDING THE CASTLEGATE ESCARPMENT AND PROPOSED MINING IN THE NORTH RILDA CANYON AREA OF FEDERAL LEASE U-06039, U-024317, SL-051221, U-2810.

AGENCY REQUIREMENTS:

Except at specifically approved locations, the Castlegate escarpment must be protected from mining induced failure. Where escarpment failure is proposed or anticipated, an environmental analysis would be needed to assess the following:

a. How much escarpment could fail based on analytical methods, observation of similar areas, geologic/topographic conditions, and panel orientation.

b. What resources would be affected by escarpment failure and description of the nature and magnitude of these effects (ie: vegetation; wildlife and habitat; threatened/endangered and sensitive species; cultural and paleontological resources; hazards; visual quality; etc.).

CASTLEGATE ESCARPMENT - NORTH RILDA CANYON AREA:

The Castlegate Sandstone escarpment within the North Rilda Permit Application area has been defined in the permit application in two (2) distinct portions:

NORTH CASTLEGATE ESCARPMENT - NORTH RILDA CANYON AREA

The Castlegate Sandstone escarpment within the northern portion of the North Rilda Area (north face of the ridge) has very limited surface exposure due to the presence of talus slopes and forest vegetation which cover most of the escarpment in this area. Due to the limited surface exposure of the Castlegate escarpment (refer to Castlegate Sandstone Outcrop - South Side of Mill Fork Canyon), mine layout of the North Rilda area (i.e.; the four (4) northernmost longwall panels

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in the Blind Canyon and Hiawatha Seams - North Rilda Area) will be consistent with previous design methods employed on the south side of Rilda Canyon. Environmental monitoring will consist of 1) annual raptor surveys conducted in conjunction with the Division of Wildlife Resources, 2) subsidence assessments: [a) annual photogrammetric evaluations, b) annual aerial reviews], and 3) pre / post mining photographic analysis.

The northern Castlegate Sandstone escarpment in the North Rilda Canyon area is similar in geology, slope, vegetative cover and physical layout to many portions of the Castlegate escarpment already undermined on the south side of Rilda Canyon. The following section presents a comparison of the Castlegate escarpments of these two areas and the effects of full-extraction mining on the escarpment on the south side of Rilda Canyon, and anticipated mining impacts on the north Castlegate escarpment of the North Rilda Area.

Castlegate Sandstone Subsidence - Related Features on the South Side of Rilda Canyon and Predicted Subsidence Effects on Castlegate Outcrops on the South Side of Mill Fork Canyon:

South Side of Rilda Canyon

Portions of the Castlegate Sandstone outcrop or "escarpment" on the south side of Rilda Canyon have been undermined by Deer Creek Mine longwall mining from March 1995 to April 1997 (see Drawing # DU1688D, Castlegate Escarpment Comparison). Longwall mining under this escarpment is essentially complete. Approximately 16,500 linear feet of escarpment have been undermined in the Rilda Canyon area.

During routine subsidence monitoring overflights in May 1996, several subsidence - related features were noted on the Castlegate outcrop in areas mined from March 1995 to April 1996:

On the eastern portion of the outcrop undermined March 1995 to January 1996 in 5th, 6th, and 7th East longwall panels, several minor subsidence - related disturbances were noted (see two drawings titled Castlegate Sandstone Outcrop - South Side of Rilda Canyon). These included 7 separate rock rolls, some of which had toppled individual trees and 3 ground tension cracks just above the outcrop. None of these features would be visible to a casual observer in Rilda Canyon.

On the western portion of the outcrop, over the 8th West longwall panel, a larger subsidence - related feature, a rock fall, has separated from a prominent Castlegate point and slid down a forested slope to the canyon bottom, creating a visible rock fall feature. This fall occurred on a narrow protruding point with an approximately east-west face. Jointing of the Castlegate is approximately north - south in this area. The area affected is approximately 200 feet long by 50 to 100 feet high. The cliff face has split off in two distinct spots, the larger on the east and the smaller on the west. The two falls merge about 200 feet below the escarpment, and continue to the canyon bottom.

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South Side of Mill Fork Canyon

On the south side of Mill Fork Canyon, the Castlegate Sandstone outcrops in the midst of a heavily forested north-facing slope, presenting outcrop features generally less steep and cliff-like than those outcrops of the eastern portion of the south side of Rilda canyon (see Castlegate Sandstone Outcrop comparison photographs for Rilda and Mill Fork canyons). Four prominent points and a few rocky slopes protrude from the dense forest cover. According to the current Energy West Deer Creek mine plan, approximately 8,000 linear feet of Castlegate Sandstone outcrop are projected to be undermined. Based on a geologic assessment including outcrop mapping and photographic analysis, the outcrop of the Castlegate Sandstone in terms of cliff exposure is limited to approximately 1,200 linear feet located in Section 21, T. 16 S., R. 7 E. Subsidence - related features along this outcrop are expected to be at most similar and probably less severe than those along the south side of Rilda Canyon which included minor rock rolls and one area of cliff failure noted earlier.

SOUTH CASTLEGATE ESCARPMENT - NORTH RILDA AREA

The Castlegate Sandstone escarpment within the southern portion of the North Rilda Area (south face of ridge) has a prominent surface exposure. Maleki Technologies, Inc. completed a geotechnical study evaluating the potential effects of longwall (full-extraction) mining on the stability of the Castlegate escarpment (i.e.; Cottonwood Newberry Canyon / Corncob Wash and Trail Mountain 5th East / Cottonwood Canyon Test Areas), and developed a predictive escarpment/mining model for the south Castlegate Escarpment - North Rilda Area. The model developed from these studies forecast effects of proposed mining under the escarpment within the southern portion of the North Rilda Area (ie: The two (2) southern most longwall panels proposed in the Blind Canyon and Hiawatha Seams - North Rilda Area).

. APPROVED R2P2 MAP NOTATION - NORTH RILDA AREA

As noted on the approved Resource Recovery and Protection Plan (R2P2) map, "ACTUAL LONGWALL CONFIGURATION OF THE NORTH RILDA CANYON RESERVES IS SUBJECT TO ON-GOING CASTLEGATE ESCARPMENT STUDIES AND ON ACTUAL RESERVE LOCATION WITH REGARDS TO POSSIBLE OUTCROP BURN AREAS".

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OVERVIEW / SCOPE OF ON-GOING CASTLEGATE ESCARPMENT GEOTECHNICAL MODEL EVALUATION; PACIFICORP/ENERGY WEST & MALEKI TECHNOLOGIES:

Since 1985/1986, PacifiCorp has been actively involved in evaluating, predicting, modeling and documenting full-extraction mining effects to the Castlegate escarpment. With the Newberry Canyon and Corncob Wash studies, numerical models were developed from field observation to back analyze and predict escarpment failure. The 2-D numerical models developed from these initial test section studies (ie: USBM / Seegmiller / Pariseau) were, for the most part, inconclusive and incomplete.

In 1996/1997, PacifiCorp set up another test section at the Trail Mountain Mine in Cottonwood Canyon (ie: 5th East LW Test Section). In addition to this field test section, a geotechnical project was initiated with Maleki Technologies and is presently on going.

The scope of the Maleki Technologies (Castlegate Escarpment Geotechnical Evaluation) project was as follows:

- Back analyze existing data from the Newberry Canyon and Corncob Wash studies (ie: field survey data, geologic/ lithologic data used, mining orientation/sequence, 2-D model development [USBM, Seegmiller, University of Utah]), and summary of conclusions.

- Selection of a separate study area within the existing Newberry Canyon/Corncob Wash Test Section. Development of a separate/updated 2-D finite element model to evaluate this modeling for conclusive escarpment failure results as compared to the post mining field data.

- Development of a separate (simplified) "risk/failure" mathematical probability model (through the use of linear regression) based on an updated geotechnical/geologic parameter survey of the new study area used in the above referenced new 2-D finite element model. Evaluate this modeling for conclusive escarpment failure results as compared to the post mining field data.

- Select the "best fit" model from the above referenced trial models and simulate the full-extraction mining of the Trail Mountain 5th East longwall within the test section. Recalibrate model to fit the field results of the Trail Mountain/Cottonwood Canyon Test Area.

- Evaluate the existing Colorado Rockfall Simulation Program (CRSP) with regard to the modeling and prediction of rock- fall from escarpment failure down the existing outslopes below the Castlegate formation. Recalibrate program to "best fit" field data from the Newberry Canyon/Corncob Wash and Trail Mountain/Cottonwood Canyon study areas.

- Summarize and present project findings to the applicable Federal and State regulatory agencies (with regard to modeling the southern Castlegate escarpment in the North Rilda

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Canyon Area) prior to pre-mining environmental analysis of potential impacts from full-extraction mining within the immediate area of the Castlegate escarpment in the North Rilda Canyon Area. Maleki Technologies presented the conclusion of the in-depth geotechnical study to DOGM, USFS and BLM on May 26, 1998.

SUMMARY AND CONCLUSION:

As per joint PacifiCorp and Federal/State Agency discussion, final approval of full-extraction (longwall) mining of either the northern or southern portion of the Castlegate escarpment (within the North Rilda Canyon Area) will be based on an objective environmental analysis of potential mining induced escarpment failure and subsequent resource effect.

For the northern portion of the Castlegate escarpment, within the North Rilda Canyon Area (Federal Lease U-024317), analysis may include only a site visit to the few limited areas that the Castlegate formation has surface exposure.

For the southern portion of the Castlegate escarpment, within the North Rilda Canyon Area (Federal Leases U-2810, SL-051221, U-06039), analysis may include escarpment failure and effect modeling as well as objective environmental analysis of the model prior to final (full-extraction) longwall mining approval.

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ATTACHMENT #1

GENERAL LAYOUT OF THE 4TH NORTH MAINS CROSSING THE
RIGHT FORK AREA OF RILDA CANYON
DEER CREEK MINE

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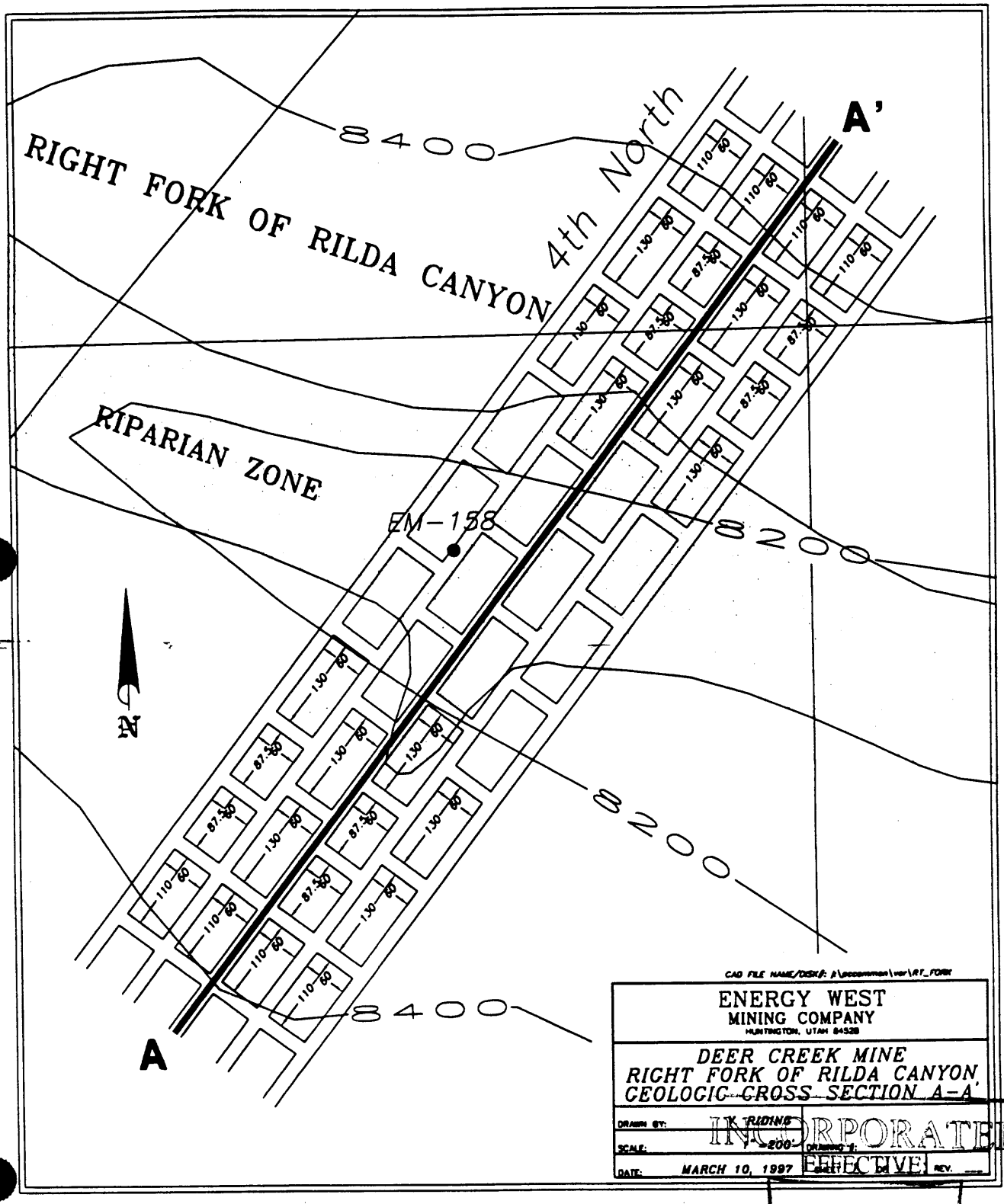

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ATTACHMENT #2

PILLAR STABILITY ANALYSIS
RIGHT FORK AREA OF RILDA CANYON
DEER CREEK MINE

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EMPIRICAL PILLAR STABILITY ANALYSIS

Equations

Average Pillar Stress (Tributary Area Loading Concept)

$$Sp = \gamma \cdot H \cdot [(\frac{w+B}{w}) \cdot (\frac{L+B}{L}) \cdot \frac{1}{144}$$

where:	Sp	- average pillar stress (psi)
	γ	- overburden unit weight (lbs/ft^3)
	H	- overburden thickness (ft)
	B	- entry width (ft)
	w	- pillar width (ft)
	L	- pillar length (ft)

Pillar Strength (as determined by field measurements at Deer Creek Mine)

σ_P = 4,000 (psi, ave.)

Factor or Safety

$$FS = \frac{\sigma_P}{Sp}$$

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EMPIRICAL PILLAR STABILITY ANALYSIS

Typical Calculation

Average Pillar Stress (Tributary Area Loading Concept)

$$Sp = \gamma \cdot H \cdot [(\frac{w+B}{w}) \cdot (\frac{L+B}{L}) \cdot \frac{1}{144}$$

where:	Sp	? - average pillar stress (psi)
	γ	158 (lbs/ft^3, as determined by measurements at Deer Creek Mine.)
	H	640 (ft)
	B	20 (ft)
	w	60 (ft)
	L	110 (ft)

$$Sp = 158 \cdot 640 \cdot [(\frac{60+20}{60}) \cdot (\frac{110+20}{110}) \cdot \frac{1}{144}$$

Sp = 1,106.5 (psi)

Pillar Strength (as determined by field measurements at Deer Creek Mine)

σ_P = 4,000 (psi, average)

Factor or Safety

$$FS = \frac{\sigma_P}{Sp}$$

$$FS = \frac{4000}{1106.5}$$

FS = 3.61

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Average Pillar Factors of Safety along the Projected 4th North Mains

Location	Cross-Section	Overburden (H)	Pillar Dimensions (w)	Pillar Dimensions (L)	Pillar Strength σ_p	Pillar Stress *Sp* *	Factor of Safety FS
Right Fork of Rilda Canyon South Western Edge	Detail A - A'	635	60	110	4,000	1,098	3.64
Right Fork of Rilda Canyon South Western Edge Riparian Zone	Detail A - A'	150	60	130	4,000	253	15.80
Right Fork of Rilda Canyon Lowest Cover Along Cross-Section	Detail A - A'	99	60	130	4,000	167	23.94
Right Fork of Rilda Canyon North Eastern Edge Riparian Zone	Detail A - A'	188	60	130	4,000	317	12.60
Right Fork of Rilda Canyon South Western Edge	Detail A - A'	648	60	110	4,000	1,120	3.57

where:

Sp	?	(psi)
γ	158	(lbs/ft^3)
H	varies	(ft)
B	20	(ft)
w	60	(ft)
L	varies	(ft)

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ATTACHMENT #3

ROOF BEAM ANALYSIS
RIGHT FORK AREA OF RILDA CANYON
DEER CREEK MINE

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Beam Analysis

Overview:

Beam theory suggests, that when an underground opening is excavated, the immediate roof strata acts as a beam to support the strata overlying the opening. If the beam is strong enough to support itself and the effected overlying strata, then the opening will be stable.

Derivation:

Rock beam failure occurs when the peak stress in the beam exceeds the beam strength. The peak stress in the beam is determined by the flexure formula,

$$\sigma_{max} = M \cdot c/I$$

where,

M = maximum moment about the neutral axis
c = perpendicular distance from the neutral axis of the beam to its outermost fiber
I = the moment of inertia of the cross-sectional area of the beam computed about the neutral axis of the beam

Mine roof strata are rectangular in cross-section, and thus, the moment of inertia is given by:

$$I = b \cdot h^3/12$$

where,

b = the breadth of the section, assumed to be 1 foot in length, parallel to the long axis of the mine entry
h = height of the beam

The rock beam is loaded with a uniformly distributed load, thus the moment within the beam is given by:

$$M = w \cdot L^2/8$$

where,

w = uniformly distributed load along the beam
L = the length of the beam, and in this case, the width of the entry

The uniformly distributed load, is calculated by:

$$w = \gamma \cdot H \cdot b$$

where,

γ = the density of the overburden
H = the height of the effected zone

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b = the breadth of the section, assumed to be 1 foot in length, parallel to the long axis of the mine entry

Equating the above relationships leads to the following equation for peak stress in the beam:

$$\sigma_{max} = (3/4) \cdot \gamma \cdot H \cdot (L/h)^2$$

where,

γ = the weight of the overburden
H = the height of the effected zone
L = the length of the beam
h = height of the beam

Discussion

The immediate roof strata overlying the Blind Canyon coal seam in the general area of the proposed Deer Creek Mine's 4th North Mains / Right Fork crossing of Rilda Canyon ranges from approximately 100 - 125 feet in total thickness and consists of interbedded sandstones / mudstones, massive sandstone, and alluvial fill (see Attachment #1).

To address the stability of the mine openings within the Right Fork of Rilda Canyon, beam theory will be employed. Beam theory suggests, that when an underground opening is excavated, the immediate roof strata acts as a beam to support the strata overlying the opening. If the beam is strong enough to support itself and the effected overlying strata, then the opening will be stable.

At the Deer Creek Mine, primary standard roof support consists of 5 feet resin roof bolts installed on 5 feet centers. This primary roof support locks the stratified layers of the immediate roof together, effectively forming a beam of support for the mine opening. The roof lithology immediately above the coal seam in the Right Fork of Rilda Canyon consists of 1.1 feet of sandstone followed by a 4.1 feet interbedded layer. The roof bolts lock these two lithologic units together forming a 5.2 feet rock beam in the roof.

When an underground opening is excavated, the stress distribution in the surrounding rock mass changes. The support that the excavated material supplied to the surrounding rock is no longer there. The stress therefore arches over the opening and redistributes itself to the surrounding rock.

In underground openings, it is accepted that the zone of influence of an opening is twice the height of the mine opening. In beam theory, when an underground opening is excavated, the strata overlaying the mine opening acts as a beam to support the immediate roof, or the material within the opening's effected zone.

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Some rules of thumb in underground excavation are: the height of the effected strata is 2 times the height of the mine opening; and that mine openings that are more than 1 diameter apart do not interact to a significant degree. The proposed mine layout in the general area of the 4th North Mains / Right Fork crossing of Rilda Canyon consists of 5 entries with pillars on 150 x 80 feet centers with entry dimensions of 8 feet high and 20 feet wide. Taking the two rules of thumb into account, with a mine opening height of 8 feet, and mine openings that are more than 20 feet apart, the total height of the material to be supported is assumed to be 16 feet, including the beam (see Attachment #2).

Assumptions:

$\gamma = 151.3\ lb/ft^3$
$H = 16$ feet
$L = 20$ feet
$h = 5.2$ feet

Calculations:

$$\sigma_{max} = (3/4) \cdot (151.3) \cdot (16) \cdot (20/5.2)^2$$

$$\sigma_{max} = 186.51 \text{ psi}$$

Beam Stability:

Beam stability is evaluated by calculating its factor of safety. The factor of safety is the tensile strength of the beam divided by the maximum tensile stress that the beam is subjected to. The factor of safety is thus:

$$FS = \sigma_{pillar\ strength} / \sigma_{pillar\ stress}$$

where,

$\sigma_{pillar\ strength}$ = 918.25 psi, as determined from strength tests of East Mountain rock types
$\sigma_{pillar\ stress}$ = σ_{max}, as calculated above

$\therefore FS = 918.25/186.51$

$$FS = 4.92$$

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A factor of safety of 1.5 to 2.0 indicates long term stability. The calculated factor of safety of 4.92 indicates long term stability of the beam, and thus the entries.

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Attachment #1

Coal Lithologic Log

Drill Hole: EM-158

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PACIFICORP ELECTRIC OPERATIONS
FUEL RESOURCES
COAL LITHOLOGIC LOG

PROJECT: EAST MOUNTAIN
DRILL HOLE: EM-158
PAGE 1 of 3

LOCATION: RIGHT FK RILDA CANYON
COLLAR ELEV.: 8120.76
HOLE TYPE: CORE
PLUG INTERVAL: NONE
CORE INTERVAL: 0 - 226.5
TOTAL DEPTH: 226.5
DATE: 10/20/96
SCALE: 1" = 10'
GEOLOGIST: K.S. FLECK

GEOPHYSICAL DATA

LOG	FROM	TO
DENSITY: XX	85	225
H.R.D.:		
E. LOG:		
GAMMA:		
CALIPER:		
S.P.:		

COAL SUMMARY:

SEAM	THICK	INT.
BC	8.8	78.4
HIA.	7.1	

DEPTH	PLUG	CORE	GRAPHIC LOG	FORMATION NAME	LITHOLOGIC DESCRIPTION	R.Q.D.	BOX #	RUN #	% REC.	SAMPLE
0					0 - 50(?) ALLUVIUM, MOSTLY SOIL WASHED AWAY, RECOVERED PORTION SS BOULDERS 1-2' DIAM.			7.5	0	
10								17.5	32	
20							1	27.5	18	
30								37.5	16	
40								45.5	25	
								47.5		
50					50 - [illegible] SANDSTONE, FINE [illegible]		2	57.5	32	
60							3	66.5	16	
70									72	

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PACIFICORP ELECTRIC OPERATIONS
FUEL RESOURCES
COAL LITHOLOGIC LOG

PROJECT: EAST MOUNTAIN
DRILL HOLE: EM-158
PAGE 2 of 3

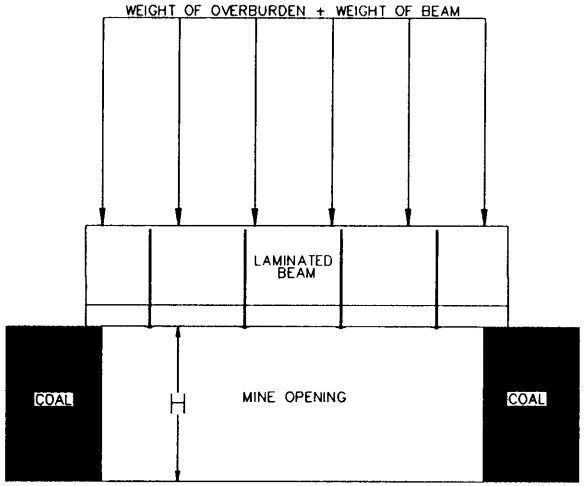
DEPTH	PLUG	CORE	GRAPHIC LOG	FORMATION NAME	LITHOLOGIC DESCRIPTION	R.Q.D.	BOX #	RUN #	% REC.	SAMPLE
70					72.5 - 77.9 MUDSTONE, SILTY, WEATH., COARSE TO SILTSTONE BELOW	20 BREAKS	3	8	72	
80					77.9 - 81.3 SANDSTONE, VFG., W/ 20% MS INTERBEDS VERT. WEATH. FRACT. 77.9-81.0	16 BREAKS	4	9	94	
					81.3 - 109.6 SANDSTONE, M.G., MASSIVE, CCC. COAL LAMS, BUFF-TAN, SL. WEATH. SL. SUGARY BECOMES COARSE @ BOTTOM		86.5	86.5		
90						6 BREAKS	5	10	100	
							96.5	96.5		
100					OBLIQUE WEATH. FRACTURE @ 101.9-102.1	7 BREAKS	6	11	100	
							106.5	106.5		
					ABRUPT CONTACT, PLATY MS LAM.					
110					109.9 - 110.6 SANDSTONE VFG. OCC CARB & MS LAMS					
					110.6 - 111.2 INTERBEDS, MS 70% SS 30% SL. PLATY, BURROWED	2 BREAKS	7	12	99	
					111.2 - 111.9 SANDSTONE F.G., MASSIVE, HARD					
					111.9 - 116.0 INTERBEDS, SANDSTONE 55% MS 45% OCC. PLATY, BURROWED		116.5	116.5		
				ABRUPT	116.0 - 117.1 SANDSTONE F.G. W/MS INT. 10% PLATY					
120			COAL		117.1 - 125.9 COAL, BLIND CANYON		8	13	102	1 117.1 2 118.5 3 120.3 4 122.1 5
					MEAS. SS [illegible] V. PRESENT [illegible] 2.5 COAL [illegible] 2.5 [illegible] 56 V. RES. [illegible] V. RES. [illegible] 120.7-121.2 LAMINED W/ ROOT? 122.9-123.1 BRANCH MS INT.		126.0			
					125.9-126.0 BONE, CMS SANDY					
				ABRUPT	126.0-128.9 SILTSTONE, MUDDY HD. CARB STKS @ TOP					
130					128.9 - 134.0 SILTSTONE, W/MS INT., MUDDIER & PLATIER 2ND PART. [illegible] BACKS THROUGHOUT, CAUSE [illegible] BLOCKY & BROKEN [illegible]		9	14	98	
					134.0-136.5 SILTSTONE, SL. MUDDY, HD.		135.2	136.5		
				ABRUPT	136.5-137.0 CMS BLACK COALY, V. PLATY					
					137.0-[illegible] SILTSTONE MUDDY, HD.					
140					[illegible] MUDSTONE, LT-DK GRAY V. SOFT ZONES @ [illegible]			15	90	
					[illegible] SILTSTONE, LIGHT, HARD, GRADES INTO SS.		145.8			
				GRAY	147.5-148.7 SANDSTONE F.G., MASSIVE		11	16	100	
150							155.6	16		
				ABRUPT	[illegible]					
160					158.7-[illegible] MUDSTONE GRAY, HD. SILTY					

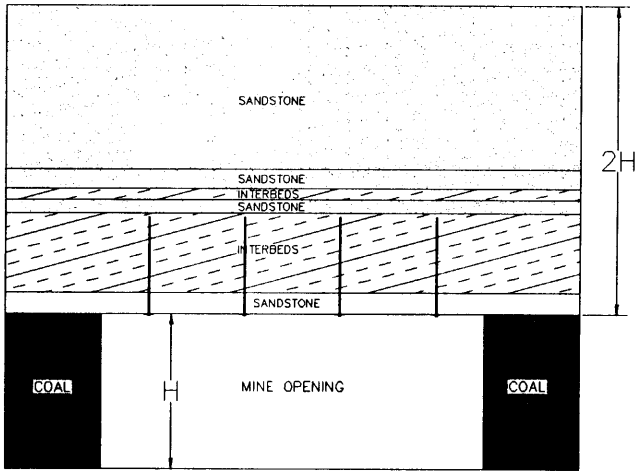
INCORPORATED
EFFECTIVE
97-1
AUG 04 1997
UTAH DIVISION OIL, GAS AND MINING

Attachment #2

Stress Distribution in Laminated Beam

INCORPORATED
EFFECTIVE:
AUG 04 1997
97-1
UTAH DIVISION OIL, GAS AND MINING





INCORPORATED
EFFECTIVE:
AUG 04 1997
97-1
UTAH DIVISION OIL, GAS AND MINING

RECEIVED
MAY 14 1997
DIV. OF OIL, GAS & MINING

CAD FILE NAME/DISK#: BEAM

ENERGY WEST
MINING COMPANY
HUNTINGTON, UTAH 84528

DEER CREEK MINE
RIGHT FORK OF RILDA CANYON
BEAM ANALYSIS

DRAWN BY:	VAN RIDING		
SCALE:	1" = 10'	DRAWING #:	
DATE:	MARCH 19, 1997	SHEET 2 OF 2	REV. ___

R645-301-500 ENGINEERING SECTION

APPENDIX B

♦ CORRESPONDENCE LETTERS
♦ AGREEMENTS
♦ APPROVALS

R645-301-500 ENGINEERING SECTION

APPENDIX B

♦CORRESPONDENCE LETTERS

♦Contents

Utah Division of Oil, Gas & Mining Conditional Approval Letter, Dated October 22, 1999 (Consent to Limited Access: Left Fork Facilities of Rilda Canyon)

USFS Letter of Consent and Decision Memo, Dated October 25, 1999 (Consent to Limited Access: Left Fork Facilities of Rilda Canyon)

Utah Division of Wildlife Resources Letter of Approval, Dated June 9, 1999 (Consent to Limited Access: Left Fork Facilities of Rilda Canyon)

UDOT Encroachment Permit (Assess SR31 From Emery Road #306)

Emery County Road Encroachment Permit (Transportation of Materials to Left Fork Facilities of Rilda Canyon)

North Emery Water Users Association Approval Letter (Transportation of Materials to Left Fork Facilities of Rilda Canyon)

Rilda Road Evaluation: Left Fork Facilities Access Road

UTAH DIVISION OF OIL, GAS, AND MINING CONDITIONAL APPROVAL LETTER

99B

State of Utah
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING

Michael O. Leavitt
Governor
Kathleen Clarke
Executive Director
Lowell P. Braxton
Division Director

1594 West North Temple, Suite 1210
PO Box 145801
Salt Lake City, Utah 84114-5801
801-538-5340
801-359-3940 (Fax)
801-538-7223 (TDD)

October 22, 1999

Chuck Semborski, Environmental Supervisor
Energy West
P. O. Box 310
Huntington, Utah 84528

Re: Conditional Approval of Rilda Canyon Access, PacifiCorp, Deer Creek Mine, ACT/015/018-99B, File #2, Carbon County, Utah

Dear Mr. Semborski:

The Division has completed the review of your proposal to access the Deer Creek Mine by way of Rilda Canyon. Your submittal dated October 7, 1999 adequately addressed the deficiencies previously sent to you on August 5, 1999. The Division hereby approves your application contingent upon the following conditions being completed.

1. Seven clean copies of the amendment must be submitted to the Division by no later than November 22, 1999 for incorporation into the approved Mining and Reclamation Plan and for distribution.

2. Prior to using the Rilda Canyon road for access to the Deer Creek Mine, PacifiCorp must obtain the endorsement of the Manti La Sal National Forest for the design adequacy of the Rilda Canyon Road above the gate, as well as an endorsement to leave the access gate open while the mine disturbed area is being accessed.

If you have any questions regarding this approval or the conditions, please call me at (801) 538-5325 or Pete Hess at (435) 613-5622.

Sincerely,

Daron R. Haddock
Permit Supervisor

tm
cc: Janette S. Kaiser, USFS
Miles Moretti, Price DWR
Price Field Office
O:\015018.DER\FINAL\app99bltr.wpd

QYB

USFS LETTER OF CONSENT AND DECISION MEMO

United States
Department of
Agriculture

Forest
Service

Manti- La Sal
National Forest

Supervisor's Office
599 West Price River Drive
Price UT 84501
Phone # (435) 637-2817
Fax # (435) 637-4940

File Code: 2820-4

Date: October 25, 1999

Mary Ann Wright
Utah Department of Natural Resources
Division of Oil, Gas and Mining
1594 West North Temple, Suite 1210
P.O. Box 145801
Salt Lake City, Utah 84114-5801

Dear Mary Ann:

We have reviewed Energy West's Mine Plan Amendment, subsequent submissions, and the Division's Technical Analysis regarding the proposal to haul bulk materials to the Deer Creek Mine via the Rilda Canyon Left Fork breakout and access road.

We hereby consent to approval of the amendment by the Division subject to the following provisions/modifications:

- Modify Stipulation 10 on page 43 of the permit amendment to "Usage of the Rilda Canyon Road will be limited to the period from April 15 through December 1 or as directed by the Utah Division of Wildlife Resources to protect the winter range and raptors and as directed by the Forest Service to protect National Forest System resources."
- Snow removal on the breakout access road is limited to Forest Service case-by-case approval, to remove drifts which remain after the remainder of the road is clear of snow and has dried sufficiently to allow hauling which would not cause rutting or other damage.
- The Forest Service reserves the right to stop hauling at any time due to unforeseen public safety concerns or site specific conditions such as resource damage, fire, or road damage.
- The operator is responsible to prevent any unauthorized use of the breakout access road during hauling and at all other times by appropriate actions, signs, gates, and barricades, subject to Forest Service concurrence.
- A dust suppression method (other than just watering) must be implemented after the 1999 field season to minimize the number of truck trips on the breakout access, subject to Forest Service approval.

A copy of the Forest Service Decision Memo for this proposal is attached for your information.

993

Modifications to the plan may be necessary at the end of the test period on December 1, 1999, to address concerns. The Forest Service must be consulted regarding modifications to the amendment or additional requirements needed to address concerns.

If you have any questions, please contact Jeff DeFreest or Carter Reed at the Forest Supervisor's Office in Price, Utah.

Sincerely,

for
JANETTE S. KAISER
Forest Supervisor

Enclosure

cc:
Bob Willey, Energy West
P.O. Box 310
Huntington, Utah 84528

Pete Hess, Utah Division of Oil, Gas and Mining
Price Field Office, 451 East 400 North
Box 156
Price, Utah 84501

Jeff DeFreest, D-2/3

Brent Barney

9413

Decision Memo

PACIFICORP/ENERGY WEST
BULK MATERIALS HAULING ON RILDA CANYON ROAD
DEER CREEK MINE

USDA Forest Service, Intermountain Region
Manti-La Sal National Forest
Ferron-Price Ranger District
Emery County, Utah

I. INTRODUCTION

The Manti-La Sal National Forest has evaluated a proposal by Energy West, Deer Creek Mine to haul bulk materials to their breakout portal and pad in the South Fork of Rilda Canyon. The proposal would allow Energy West to haul the proposed materials via existing surface roads which is less costly than hauling them through the underground workings from the Deer Creek Mine portal complex. The subject roads and the breakout pad already exist and are under appropriate permits. Hauling on State highways has been approved by the Utah Department of Transportation. Hauling on the County road in Rilda Canyon from State Hwy. 31 to the breakout pad access road has been approved by Emery County through issuance of an encroachment permit. No expansion or reconstruction of these facilities on National Forest System lands is proposed or reasonable foreseeable. The facilities on National Forest System lands have been determined to be suitable for the proposed activity. Bulk materials to be hauled to the breakout portals and pad would consist of longwall support CANS/cribs, gravel, and Omega block. Hauling would consist of a maximum 28 loads per week (average of 5.4 trucks per day). Only one truck would be in the canyon at a time and hauling would be limited to the period between April 1 and December 1 as weather permits. The actual start and stop time between these dates would be subject to approval by the Division of Wildlife Resources and Forest Service based on weather, wildlife activities in the canyon, and road conditions. No hauling would take place on weekends, holiday weekends (including the prior Friday and actual holiday) or the openings of the general big-game hunting seasons (including the day prior to the opening day). Hauling would not take place when the road surface is wet enough to be susceptible to damage and would be limited to daylight hours. No hauling of materials from the breakout pad would take place. Some of the CANS and gravel would be stockpiled on the pad in approved areas but most materials would be transported into the mine as they are unloaded from the trucks. The area of the proposed action lies on National Forest System lands administered by the Ferron-Price Ranger District of the Manti-La Sal National Forest. The breakout and breakout pad access road occupy approximately 2 acres of National Forest System lands and are located in Section 9, Township 16 South, Range 7 East, Salt Lake Meridian, in Emery County, Utah, within Federal Coal Lease U-050862 and U-06039, within the approved permit boundary of the Skyline Mine.

The proposal was submitted to the Utah Division of Oil, Gas and Mining in the form of a permit amendment to the Mine Permit for the Deer Creek Mine. Forest Service consent is required under the Federal Coal Leasing Amendments Act of 1975, Surface Mining Control and Reclamation Act of 1977 and associated Federal Regulations, and the Utah Coal Rules. The Forest Service consent decision is subject to analysis under the National Forest Management Act of 1976, and National Environmental Policy Act of 1969.

II. DECISION

I have decided to consent to approval of the proposed hauling by the Utah Division of Oil, Gas and Mining as proposed by Energy West subject to the attached provisions for the protection of non-coal resources on National Forest System lands.

It is my determination that this decision may be categorically excluded from preparation of an Environmental Assessment (EA) or Environmental Impact Statement (EIS) under Forest Service Handbook 1909.15, Chapter 30, Section 31.2(3): "Approval, modification, or continuation of minor special uses of National Forest System lands that require less than five contiguous acres of land." This category was determined appropriate because the area affected by this decision is less than 5 acres, no impacts to surface resources or hydrology are anticipated, and surface uses would remain essentially the same.

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My decisions will be implemented via this Decision Memo and subsequent consent letters that will be sent to the the Director, Utah Division of Oil, Gas and Mining.

III. DECISION RATIONALE

This decision was made after careful consideration of the proposal, public involvement, and the entirety of the supporting record. No one fact or single piece of information led to the decisions. Rather, a combination of factors contributed to it. The key considerations are discussed in the following sub-parts:

Attainment of Agency Goals:

The general purpose and need for this project is to accomplish the following goal of the Forest Plan: "Provide appropriate opportunities for and manage activities related to locating, leasing, development, and production of mineral and energy resources." (Forest Plan, p. III-4). Another related goal of the Forest Plan is: "Manage geologic resources, common variety minerals, ground water, and underground spaces (surficial deposits, bedrocks, structures, and processes) to meet resource needs and minimize adverse effects."

The proposal lies within an MMA (Minerals Management) and an RNG (Range) Forest Plan Management Unit. MMA Management Units are managed with emphasis on leasable mineral operations such as coal mining operations. RNG Management Units are managed for emphasis on Livestock and Wildlife Grazing. Mineral activities are allowed with appropriate mitigations to assure that operations are consistent with Forest Plan goals for management of resources.

The project-specific purpose and need of the proposed action is to provide for economical mineral activities while protecting natural resources of the National Forest consistent with Forest Service policy and Forest Plan direction.

The decision wholly meets the project's purpose and need.

Absence of Extraordinary Circumstances:

Existing resource conditions and potential extraordinary circumstances have been considered in making the decisions.

Steep slopes or highly erosive slopes. The proposed project areas are located in the bottoms of canyons away from steep slopes and highly erosive slopes.

Threatened and endangered species or their critical habitat. The project will involve hauling of materials on existing roads during non-critical periods of time regarding wildlife habitat and occupation. No water will be used, depleted, or diverted. There should be no impact to any species.

Floodplains, wetlands, or municipal watersheds. There will be no use, depletion, or diversion of the water. There should be no effect on the floodplain or wetland.

Congressionally designated areas, such as wilderness, wilderness study areas, or National Recreation Areas. There are no wilderness, wilderness study areas, or National Recreation Areas in or adjacent to the project area.

Inventoried roadless areas. The project area is not within an inventoried roadless area or an unroaded area contiguous to an inventoried roadless area.

Research Natural Areas. The project area is not located within any Research Natural Areas (RNAs).

Native American religious or cultural sites, archeological sites, or historic properties or areas. Because the hauling would be on existing roads and would not involve additional surface disturbance, professional archaeological staff have determined that the project does not have the potential to affect historic properties.

Relationship to Public Involvement:

Public comments were sought through scoping and considered throughout the planning process for this project. Project scoping responses are described in the next section.

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IV. PUBLIC INVOLVEMENT

Legal notices describing the proposal and requesting issues/comments were published in the *Sun Advocate* (Price, Utah) and the *Emery County Progress* (Castle Dale, Utah) on June 8, 1999. Letters describing the proposal and requesting issues/comments were mailed to 18 interested individuals/agencies on June 7, 1999. Four response letters were received with comments as described below.

Utah Mining Association - Supports approval of the requested permit amendment to preserve the Carbon and Emery County economies and their standard of living.

Utah Division of Wildlife Resources - Stated that restricting hauling to the period between April 15 and December 1 as proposed would be sufficient to protect wildlife.

North Emery Water Users Association - Objected to transporting of any hazardous materials (oil, greases, fuels, etc.) on the Rilda Canyon Road due to the potential for a wreck or spillage. The Rilda springs which lie downstream of the breakout in Rilda Canyon adjacent to the road and have been developed by North Emery Water Users Association to provide culinary water and are directly influenced by the creek above. Any spillage could contaminate the springs.

Emery Water Copnservancy District - First the District is concerned that the increased truck traffic on the existing road will have a definite negative impact on the environment in the area. We do not see an evaluation of protective measures to be taken to prevent pollution to the streams due to road sediment seeping into the system. Second, it appears that no time table has been expressed as to how long the road will be in use and what will become of this access road when it's use is no longer necessary. Third, we question what guarantees have been put into place that this road will be used only for hauling bulk materials. It is the main emphasis and concern of the Emery Water Conservancy District that the water and the watershed within the forest boundaries be protected.

A meeting at the Forest Supervisor's Office in Price, Utah was held on July 23, 1999 between the Forest Service and water users groups. North Emery Water Users Association and Emery Water Conservancy District were represented. The proposed project was discussed. Both groups agreed that if their concerns were addressed they would have no objection to Forest Service consent to the proposal. It was explained that Energy West has not proposed to haul anothing other than the bulk materials discussed in the introduction of this Decison Memo and would not be allowed to haul any other materials without specific approval of the responsible agencies. In addition, Energy West would be required to install some additional sediment control facilities on the road and would be required to supress fugitive dust with water or some other method approved by the agencies. It was explained that the road and pad are already permitted under the Deer Creek Mine plan which includes restrictions on use of the road and requires complete reclamation of the breakout facilities, pad, and access road upon completion of mining activities. There is an adequate bond held by the Utah Division of Oil, Gas and Mining to ensure compliance. Additional concerns were brought up by the group regarding public safety and adequacy of the road to protect a spring which is located under the road which provides water to their collection system.

V. FINDINGS REQUIRED BY OTHER LAWS AND REGULATIONS

To the best of my knowledge, the decision complies with all applicable laws and regulations. In the following, the association of the decision to some pertinent legal requirements are summarized.

National Forest Management Act of 1976: The Forest Plan was approved November 5, 1986, as required by this Act. This long-range land and resource management plan provides guidance for all resource management activities in the Forest. The National Forest Management Act requires all projects and activities to be consistent with the Forest Plan. The Forest Plan has been reviewed in consideration of this project. The decision will be consistent with the Forest Plan.

Coal Leasing Amendments Act of 1975: Forest Service consent to approval of mining operations by the Utah Division of Oil, Gas and Mining (including conditions for protection of non-coal resources) is required under this act. Approval of this decision memo constitutes my consent to UDOGM.

Surface Mining Control and Reclamation Act of 1977(SMCRA): This act gives the Department of the Interior, Office of Surface Mining (OSM), primary responsibility to administer programs that regulate surface coal mining

operations and the surface effects of underground coal mining operations. Pursuant to sections 503 and 523 of SMCRA, under the oversight of the OSM, the Utah Division of Oil, Gas and Mining regulates surface coal mining and the surface effects of underground coal mining on Federal and non-Federal lands within the State of Utah. On National Forest System lands, consent must be obtained from the Forest Service, as the surface management agency, prior to approval of mining activities, including exploration drilling. Approval of this decision document constitutes my consent for approval of the mine permit amendment.

National Historic Preservation Act: The proposal would not result in any impacts for cultural or historic resources.

Endangered Species Act: The Biological Assessment/Biological Evaluation has disclosed that this project will not result in impacts to threatened, endangered, or sensitive plant or animal species. Therefore the Forest Biologist determined there is no need to further evaluate threatened, endangered, or sensitive plant or animal species.

National Environmental Policy Act: The entirety of documentation for this project supports that the project analysis complies with this Act.

VI. IMPLEMENTATION DATE AND APPEAL OPPORTUNITY

Implementation of the these decisions may occur immediately upon my signature of this document.

This decision is not subject to appeal by the public in accordance with the Code of Federal Regulations Title 36 part 215.

This decision is subject to appeal by the applicant under Code of Federal Regulations Title 36 part 251.

VII. CONTACT PERSON

For additional information concerning the Forest Service decision, please contact Carter Reed or Jeff DeFreest at the USDA Forest Service, Manti-La Sal National Forest (address: 599 West Price River Drive, Price, UT 84501; telephone: 435-637-2817).

VIII. SIGNATURE AND DATE

for

JANETTE S. KAISER
Forest Supervisor
Manti-La Sal National Forest

10/22/99
Date

99B

DECISION MEMO ATTACHMENT

CONDITIONS OF FOREST SERVICE CONSENT

- No petroleum products, liquids (other than specifically approved dust suppression products), or hazardous materials of any kind will be hauled on the breakout access road.
- Hauling will be limited to the time between April 15 and December 1. In addition, the actual start and stop dates are subject to Forest Service consent based on weather, National Forest System resources, and road conditions. The Forest Service reserves the right to stop hauling at any time due to unforeseen public safety conditions or site specific conditions such as resource damage, fire, or road damage.
- Snow removal on the breakout access road is limited to Forest Service case-by-case approval, to remove drifts which remain after the remainder of the road is clear of snow and has dried sufficiently to allow hauling which would not cause rutting or other road damage.
- No hauling will take place during holidays (Federal and State), holiday weekends (including the prior Friday), the opening weekends or the general big-game hunts (including the prior Friday).
- The operator is responsible to prevent any unauthorized use of the breakout access road during hauling and at all other times by appropriate actions, signs, gates, and barricades, subject to Forest Service concurrence.
- A dust suppression method (other than just watering) must be implemented to minimize the number of truck trips on the breakout access, subject to Forest Service approval, beyond the 1999 field season.

OPB

UTAH DIVISION OF WILDLIFE RESOURCES LETTER OF APPROVAL

9913

State of Utah
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WILDLIFE RESOURCES

Michael O. Leavitt
Governor
Ted Stewart
Executive Director
John Kimball
Division Director

Southeastern Region
475 West Price River Drive, Suite C
Price, Utah 84501-2860
801-636-0260
801-637-7361 (Fax)

9 June, 1999

Joseph C. Helfrich
Permit Supervisor
Division of Oil, Gas and Mining
PO Box 145801
SLC, UT 84114-5801

RE: DWR comments on the Rilda Canyon Surface Access Amendment, ACT/015/018, Emery Co. UT

Dear Mr. Helfrich,

The Division of Wildlife Resources has reviewed the amendment to allow surface access to the Rilda Surface Facilities and have the following comments:

- We **support** the stipulation which limits usage of the Rilda Canyon Road from April 15th through December 1st. This stipulation was requested to avoid impacts to big game during the critical winter period.

- We request that stipulation 10 on page 43 be **reworded** to state: "10. Usage of the Rilda Canyon Road will be limited to the period from April 15 through December 1, or as directed by the Utah Division of Wildlife Resources *to avoid impacts to big game during the critical winter season.*" This wording change would more accurately represent the purpose of this restriction.

- Finally, we **understand that PacifiCorp does not anticipate further development** at the Rilda Canyon Facilities (pg. 43). We feel that this is an important point, as we are concerned about the cumulative impact of projects in this area. The combination of this, and additional future projects in this area may have a greater impact on wildlife than anticipated by analyzing projects individually.

Thank you for the opportunity to review and comment on this amendment. We appreciate the opportunity to work with PacifiCorp, DOGM and the Forest Service on this amendment from its inception. For questions regarding these comments, please contact Chris Colt - Habitat Biologist at (435) 636-0279.

Sincerely,

Kevin H. Berg for Miles Moretti

Miles Moretti
Regional Supervisor

c:Pete Hess - DOGM
Bob Willey - PacifiCopr
Jeff DeFreest - USFS
H:\mp\dogm\rilda

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UDOT ENCROACHMENT PERMIT

99B

ORIGINAL

UTAH DEPARTMENT OF TRANSPORTATION

T-226(6/97)
HIGHWAY RIGHT OF WAY
ENCROACHMENT

PERMIT

99-671-44
Date: 10/01/1999

Work order #:

Region 4
District: Price

Application of: ENERGY WEST MINING CO.

Phone: 687-4720

Title: GEOLOGY/PERMITTING SUPVR

By: CHARLES SEMBORSKI

Address: PO BOX 310, HUNTINGTON UT 84528

is hereby granted, subject to UDOT's Regulations For The Accommodation of Utilities on Federal Aid and Non Federal-Aid Highway Right of Way, Regulations for the Control and Protection of State Highway Rights of Way, Standard Specifications for Road and Bridge Construction, Specifications for Excavation of State Highways, State Occupational Safety and Health Laws, Manual on Uniform Traffic Control Devices, Instructions to Flaggers, the approved plans, and any special limitations set forth herein, permission for the purpose of **ACCESS SR-31 FROM EMERY COUNTY ROAD #306 WITH TRACTOR/TRAILER FOR THE PURPOSE OF TESTING FEASIBILITY OF DELIVERY OF MATERIALS TO THE DEER CREEK MINE** within the right of way limits of Highway No. **31** Milepost No. **38.7**, in **EMERY** County, in the following locations: **HUNTINGTON CANYON, INTERSECTION OF SR-31 AND EMERY COUNTY ROAD #306**.

Receipt of $20.00 permit fee is hereby acknowledged. The work permitted herewith shall commence **10/04/1999** and shall be diligently prosecuted to completion. The work shall be completed and all disturbed surfaces or objects restored on or before **11/30/1999**. In the event work is commenced under this permit and the permittee fails or refuses to complete the work, the Utah Department of Transportation may, at its election, fill in or otherwise correct any existing deficiencies at the expense of and subject to immediate payment by the permittee.

Permittee shall execute a bond in the minimum amount of **$0.00**, as determined by the Region Director/District Engineer, to insure faithful performance of the permittee's obligation. The bond shall remain in force for three years after completion of work.

Before work permitted herewith is commenced, the permittee shall notify Dale Stapley at 636-1402, permits officer, or **Steven Acerson 687-9969**, and commencement of said work is understood to indicate that the permittee will comply with all instructions and regulations of the Utah Department of Transportation (as listed above) with respect to performance of said work, and that he will properly control and warn the public of said work to prevent accident and shall indemnify and hold harmless the Utah Department of Transportation from all damages arising out of any and all operations performed under this Permit.

Permittee shall not perform any work on State Highway right of way beyond those areas of operations stipulated on this permit.

If permittee fails to comply with Utah Department of Transportation regulations, specifications, or instructions pertinent to this permit, the Region Director/District Engineer or his duly authorized representative, may by verbal order, suspend the work until the violation is corrected. If permittee fails or refuses to comply promptly, the Region Director/District Engineer or his authorized representative may issue a written order stopping all or any part of the work. When satisfactory corrective action is taken, an order permitting resumption of work may be issued.

Special Limitations: This agreement and/or permit is UDOT approval only. You are responsible to obtain clearances from private property owners and the local jurisdiction you are working within. Contractor responsible for repairing and/or restoring any portion of the roadway damaged during construction. TRUCKS ENTERING HIGHWAY SIGN TO BE POST MOUNTED WITH ORANGE FLAGS APPROX. 1000' IN ADVANCE OF RILDA CANYON. CERTIFIED FLAGGER TO DIVERT RILDA CANYON TRAFFIC (NOT SR-31 TRAFFIC)

See Application for Signature
(Signature of Permittee)

Approved By: Dale Stapley
For (Region Director/District Engineer)

Maintenance Station No. 433 Steven Acerson 687-9969

Form T-223

UTAH DEPARTMENT OF TRANSPORTATION

Application for Right of Way Encroachment Permit

(WORK CANNOT BEGIN UNTIL PERMIT IS APPROVED)

Date 9-30, 19 99

To: Region Director/District Engineer
UTAH DEPARTMENT OF TRANSPORTATION

*(1) Application is hereby made by: Energy West Mining Co - Charles A. Semborski
*(2) Address: PO Box 310 Huntington UT 84528 Tel. No. (435) 687 4720
*(3) for permission to do the following: Exit Access State Highway 31 from Emery County Road #306 with tractor/trailer for the purpose of testing feasibility of delivery of materials to the Deer Creek Mine - Rilda Canyon Surface Facility
*(4) Location: Huntington Canyon - Intersection of State Highway 31 + Emery County Road #306 (Rilda and Trail Canyons / ERD #50246)

City _____ County Emery Highway No. 31
Milepost _____ in accordance with the attached plan *(5)

*(6) Construction will begin on or about 10/4, 19 99
and will be completed on or before 11/30, 19 99.

New underground utility installations crossing highway must be placed by boring. If boring is impossible due to unusual circumstances such as soil conditions, existing utilities, etc., a request for an exception may be made to the Region Director/District Engineer and the following information provided:

a. Type of pavement Not Applicable
b. Excavation will be N/A feet long by N/A feet wide and N/A feet deep.
c. A bond in the amount of $ _____ has been posted with _____ Tel. No. _____ to run for a term of three (3) years after completion of work to guarantee satisfactory performance.

If this permit is granted, we agree to comply with all conditions, restrictions and regulations contained in the UDOT Policy 08-87 "Accommodation of Utilities on Federal-Aid and Non Federal-Aid Highway Right of Way", and "Special Limitations" required by the Region Director/District Engineer or his duly authorized representative.

Energy West Mining Co
Developer

Charles A Semborski
Type or Print Name — Permittee

Charles A. Semborski
Signature

Geology / Permitting Supervisor
Title

*Refer to instructions on back.

To be filled in by the Region Director/District Engineer:
Permit _____ should _____ should not be granted.
Special Limitations _____

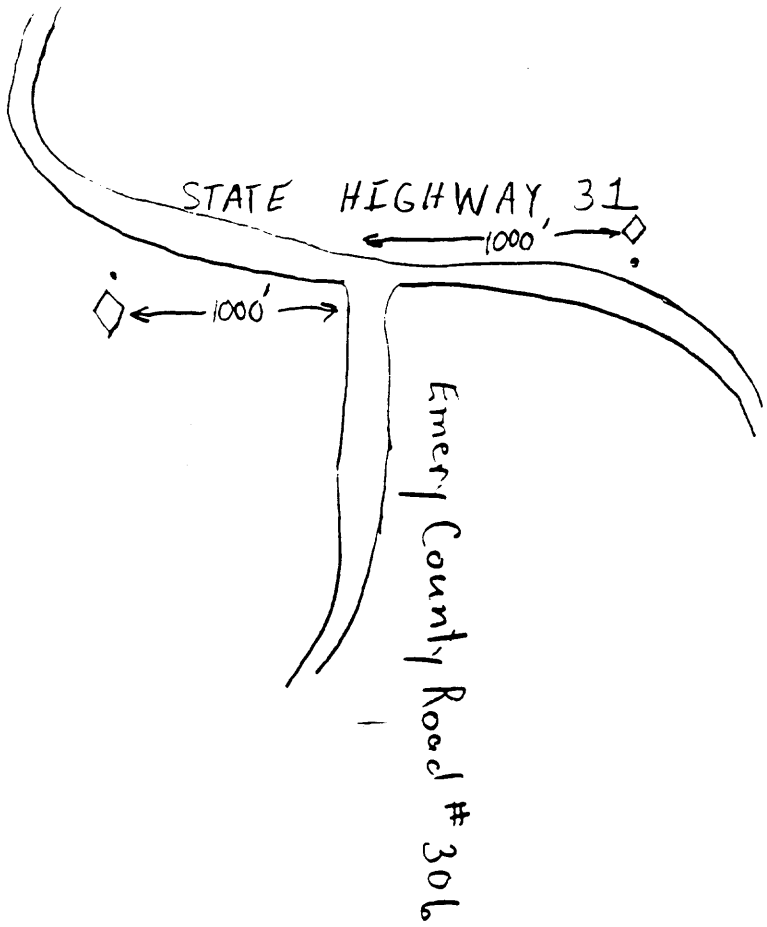
Region/District Traffic Engr. _____ Region Director/District Engineer _____

9913

Energy West Mining Co. 9/30/99

UDOT Encroachment Permit

Intersection State Highway 31 and Emery County Road # 306



◊ Traffic Signs Located on State Highway 31 approximately 1000 FT from intersection with Emery County Road #306. Sign To Be 48 in² diamond Black on Yellow (Truck Crossing) with Black on Yellow 8"X24" (1000 FT)

• Certified flag person located in best location to control access of trucks from Emery County Road #306 onto State Highway 31. Traffic will be to and from the direction of Huntington UT.

99B

INSTRUCTIONS

1. Application for this permit should be made by whoever will actually do the work, whether it be the owner or a contractor.

2. Mailing address of applicant.

3. State fully and completely the type of installation, type of construction, with, thickness, drainage data, etc., where applicable.

   If a pole line, give the following information: number of poles, total length of line, type of wire, character of service, vertical clearance over the roadway, and voltage if power line.

   If a pipe line or buried cable, give the following information: type of service, size and length of line, depth of trench, kind of pipe (sewer, gas, oil, water supply, etc.) or conduit. All transverse underground utilities must be placed under the pavement by boring. All fluid lines require encasement with suitable material. The size and length of encasement shall be satisfactory to the Utah Department of Transportation.

4. Give distance from some geographical point such as intersecting highways, city or corporate limits. Give city, county, and state or U.S. route number.

5. Attach two (2) copies of a plan showing proposed locations of structures with reference to pavement and right of way lines. If installation crosses the highway, show cross section of present roadway and proposed installation. Identify the location of other utilities that may be in conflict.

6. Give anticipated dates for beginning and for completion of proposed installations. These will be used in determining the inspection fee.

<u>Note:</u> A fee of twenty dollars ($20.00) will be charged for all Right of Way Encroachment Permits. This permit fee shall be submitted with the application. An inspection fee will also be required as outlined in UDOT Policy 08-87 "Accommodation of Utilities on Federal-Aid and non Federal-Aid Highway Rights of Ways".

UTAH DEPARTMENT OF TRANSPORTATION REGION / DISTRICT OFFICE ADDRESSES:

Region 1 - 169 North Wall Avenue / P.O. Box 12580, Ogden, Utah 84412-2580, (801) 399-5921

Region 2 - 2010 South 2760 West, Salt Lake City, Utah 84104-4592, (801) 975-4900

Region 3 - 825 North 900 West, Orem, Utah 84057, (801) 227-8000

Region 4 - 1345 South 350 West / P.O. Box 700, Richfield, Utah 84701, (435) 893-4710

Cedar City District - 1470 North Airport Road / P.O. Box 1009, Cedar City, Utah 84721-1009, (435) 865-5500

Price District - 940 S. Carbon Ave, Price, Utah 84501-0903, (435) 636-1470

Richfield District - 708 South 100 West, Richfield, Utah 84701, (435) 896-1399

99B

EMERY COUNTY ROAD ENCROACHMENT PERMIT

9F1B

EMERY COUNTY
A Great Place to Live and Work

Road Department

PERMIT

Permit #199928

Application having been made by Energy West Mining Company through Charles A. Semborski, its authorized agent, and fees and a bond being waived, and the Application having been reviewed and accepted, permission is hereby granted Applicant to proceed with the testing transportation of materials to the Rilda Canyon surface facility of Deer Creek Mine. Located on the Rilda Canyon Road #306.

Stipulations:

1. Dust control during hauling period.
2. Proper signing while hauling is in effect.
3. Posting for safety during hauling and traffic control (if needed).
4. Road repairs in the event of damages.
5. Final inspection upon completion of hauling.
6. Strict compliance with Ordinance 8-7-85A or as amended, Road Supervisor and County Engineers.
7. Must be in compliance with Utah Department of Transportation through Dale Stapley.

DATED this 4th day of October, 1999.

Supervisor

EMERY COUNTY ROAD DEPARTMENT

By

INSPECTION AND RELEASE

The Emery County Road Department Supervisor inspected said site on the _____ day of _____, 19 _____, finds the following:

___ Deficiencies which must be corrected before release can be considered.

___ Released

Supervisor

EMERY COUNTY ROAD DEPARTMENT

By _____

Person to Contact:

Name: Chuck Semborski/Bob Willey

Address: P O Box 310

Phone #: (435) 687-4720/687-4722

99B

P.O. Box 889 • 300 North 1st West • Castle Dale, Utah 84513 • Telephone (801) 381-5450 • FAX (801) 381-5239

NORTH EMERY WATER USERS ASSOCIATION
APPROVAL LETTER

94B

NORTH EMERY
WATER USERS ASSOCIATION

Box 129
Cleveland, Utah 84518
Telephone (801) 653-2649

October 12, 1999

Charles A. Semborski
Geology/Permitting Supervisor
Energy West Mining Company
P. O. Box 310
Huntington, Utah 84528

Mr. Semborski:

On October 4, 1999 several board members of the North Emery Water Users Association and I met with representatives from Energy West Mining Company to discuss the delivery of material to the Rilda Canyon surface facilities of Deer Creek Mine. Energy West Mining Company has requested permission from the Utah Division of Oil, Gas, and Mining, in conjunction with the United States Forest Service, to conduct a test to determine the feasibility of delivering solid bulk materials to the North Rilda portal facility. After discussing concerns related to the test proposal with Energy West representatives, North Emery Water Users Association supports approval of Energy West Mining Company's request to conduct a material haulage test to the Rilda Canyon portal facilities of the Deer Creek Mine. The material haulage test will be completed by December 1, 1999.

Sincerely,

Menco Copinga
President
North Emery Water Users Association

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RILDA ROAD EVALUATION

9913

ENERGY WEST Mining Co.
PO Box 310
Huntington, Utah 84528

October 1, 1999

United States Forest Service
Manti-La Sal National Forest
599 West Price River Road
Price, Utah 84501

Attention: Mr. Carter Reed

Re: Rilda Canyon Facilities Access Road

Attached you will find the report "Geotechnical Evaluation and Design Services for the Rilda Canyon Project" which includes the facility pad and access road. The report was prepared by Geotechnical Design Services. Also included, are drawings showing design details of the road. The signed and dated copies of these drawings can be found in the Deer Creek MRP in packets 3-9A, 3-9B and 4-4A. The road was constructed according to this information.

The following lists access road use since it's construction.

- During construction of the facility, Energy West imported approximately 9000 cubic yards of 2" granular material for sub-grade and fill for construction of the site. As can be seen on the attached weight tickets, the belly-dump trucks had a gross weight of 80,000 to 95,000 lbs. This equated to approximately 70 to 80 trips on the access road.
- Approximately 20 tractor/trailer loads were delivered to the site, including 38,000lbs. Transformers (2ea.), 100,000 gallon water tank, two Sub-station building halves, fan ductwork, fans, 1000 h.p. motor, etc.
- Also during construction we poured approximately 300 cubic yards of concrete, with some trucks hauling 11 yards/load.

The gross weight of the truck hauling the can cribs is 78,000 lbs and the gravel trucks/trailer will be approximately 80,000 lbs. As stated in our application for use of this road, "The road will not be used when wet and susceptible to damage." This will prevent damage to the top course of enzyme treated road base.

If you have any additional questions please contact me.

John Christensen

John Christensen
P. E. 165651, Utah
Sr. Construction/Industrial Engineer
Energy West Mining
15 N. Main
Huntington, Utah 84528
435-687-4725
Email: john.christensen@pacificorp.com

9913

R645-301-500 ENGINEERING SECTION

APPENDIX B

♦AGREEMENTS

♦Contents

RILDA CANYON ROAD UPGRADE

AGREEMENT
(Rilda Canyon Road Upgrade)

This Agreement is made and entered into this 09 day of August, 2004, by and between Emery County Special Services District, No. 1 ("District") having an address of P.O. Box 1055, Castle Dale, Utah 84513 and PacifiCorp, an Oregon corporation, c/o Interwest Mining Company, a wholly owned subsidiary, as its managing agent, Energy West Mining Company, its wholly owned subsidiary, as mine operator and collectively having an address c/o Interwest Mining Company, 201 South Main Street, Suite 2100, Salt Lake City, Utah 84111.

RECITALS

WHEREAS, Emery County owns and maintains a road known as the Rilda Canyon Road, identification No. 306, which runs approximately 3.0 miles from the Huntington Canyon Road, SR 31, to the mine gate in the left fork of Rilda Canyon; and

WHEREAS, Emery County Special Service District #1 was established by resolution of the Emery County Board of Commissioners to construct, repair and maintain roads within Emery County; and

WHEREAS, the District acting as agent for Emery County and the Emery County Road Department assists the County in obtaining rights-of-way, easements or permits associated with the Emery County roads; and

WHEREAS, PacifiCorp presently makes use of the Rilda Canyon Road for purposes relating to its mining operations; and

WHEREAS, the parties have come to a mutual agreement with regard to the need for certain improvements to the Rilda Canyon Road.

NOW THEREFORE, for and in consideration of the premises, the mutual covenants and agreements of the parties hereto, and the consideration in favor of the District described below, the parties hereto agree as follows:

1. PacifiCorp shall provide to the District such information as the District may request with respect to the anticipated future use by PacifiCorp of the Rilda Canyon Road in connection with the construction and use of new surface facilities related to its mining operations.

2. The District shall utilize such information provided by PacifiCorp in determining the nature and extent of any improvements that may be required to the Rilda Canyon Road.

3. The parties anticipate that the improvements to the Rilda Canyon Road will consist of one or more of the following actions:

- The reconstruction and/or reconfiguration of the intersection/ turnoff from SR 31 to the Rilda Canyon Road.

- The reconstruction, realignment, widening and surfacing of the Rilda Canyon Road to allow for increased speed and increased traffic.

- The construction of a trailhead parking area and turnaround area at the end of the reconstructed portion of the Rilda Canyon Road. The area will provide public access to a forest trail system to extend beyond PacifiCorp's facilities.

- The relocation of the existing water supply pipeline owned by North Emery Water Users Special Service District, as needed.

4. The District, will be responsible for the design of any improvements to the Rilda Canyon Road. The District will assist in the acquisition of any rights-of-way necessary to accomplish such reconstruction. The District will also be responsible for the reconstruction of the Rilda Canyon Road as well as the relocation of pipelines as required by the road relocation. The preliminary cost estimate for the Rilda Canyon Road Improvement Project is attached as Exhibit "A."

5. PacifiCorp agrees to pay to the District upon submission of progress invoices supporting the requests for payment, all costs associated with the permitting, engineering, design, and reconstruction of the Rilda Canyon Road. PacifiCorp's obligations for payment shall be subject to the following limitations:

- The District will provide PacifiCorp with project cost estimates for permitting, engineering, design and reconstruction prior to the time the costs are incurred. Once approved, the cost estimates will not be exceeded without PacifiCorp approval.

- The District will obtain PacifiCorp's prior permission before issuing a change order that will cause the total expenditures with respect to the Rilda Canyon Road to exceed the amount originally approved by PacifiCorp.

- The District will provide to PacifiCorp a copy of the Partial Pay Estimates from time to time as issued for any and all costs incurred in connection with the reconstruction of the Rilda Canyon Road.

- PacifiCorp shall be given the opportunity to audit the records with respect to such Partial Pay Estimates and the final close out of the Construction Contract.

- Payments: 30 days net.

6. The parties understand and agree that the Rilda Canyon Road is a county road for which Emery County is now and will in the future will be responsible. Furthermore, the District agrees to indemnify and hold PacifiCorp, Energy West, Interwest and each of their directors, officers, employees, agents and members of their respective boards and affiliates (indemnities) harmless of and from any liability, cost or expense, including defense costs, from any claim, demand or action which may be brought against indemnities and which arises out of or alleges any negligence or responsibility on the part of indemnities in the design or construction of the Rilda Canyon Road including any claim or demand which may be made by PacifiCorp, Interwest and/or Energy West employees. This obligation to indemnify and hold harmless commences upon execution of this Agreement and shall terminate upon completion of the reconstruction of the Rilda Canyon Road.

7. In the event the District requires immediate approval (within 24 to 48 hours) of a change order or other similar operational decision, notice may be given to PacifiCorp by personal delivery, facsimile or email as follows:

   PacifiCorp
   Attn: Carl Pollastro, Director of Technical Services
   and Project Development
   One Utah Center, Suite 2100
   201 South Main Street
   Salt Lake City, Utah 84111

   Telephone: 801-220-4695 435-650-2863
   Facsimile: 801-220-4725
   Email: carl.pollastro@pacificorp.com

   Or such other delegated representative as PacifiCorp may from time to time designate by written notice to the District.

   Any other notice given under this Agreement shall be in writing and shall be delivered personally or sent by certified mail, return receipt requested. If notice is given by mail, it shall be deemed received seventy-two (72) hours following the time of deposit to the United States mail as evidenced by the postmark on such notice, and such time shall be the effective time of the notice for the purpose of calculating any time periods provided herein. Any such notice shall be delivered or mailed to the following addresses:

If to District:
Emery County Special Service District No.1
c/o Chairman of the Board
95 East Main Street
P.O. Box 1055
Castle Dale, Utah 84513

If to PacifiCorp:
c/o Interwest Mining Company
Attn: President
201 South Main Street – Suite 2100
Salt Lake City, Utah 84111

With a copy to:
Energy West Mining Company
Attn: Manager, Administration & Technical Services
15 North Main
P.O. Box 310
Huntington, Utah 84528

8. In the event the work of reconstruction of the Rilda Canyon Road anticipated by this Agreement has not been commenced on or before December 31, 2006 either party may terminate this Agreement upon 30 days written notice to the other party. Once the actual work of reconstruction has commenced this Agreement shall terminate at the time the parties agree that the reconstruction of the Rilda Canyon Road has been satisfactorily completed.

9. This Agreement may be amended by a written agreement signed by a duly authorized representative of each of the parties.

IN WITNESS WHEREOF, the parties have caused this Agreement to be executed as of the day and year first above written.

EMERY COUNTY SPECIAL SERVICE DISTRICT No.1

By: Swasey 9 Aug 2004
Merrill A. Swasey
Chairman of the Board

By: Bevan Wilson
Bevan Wilson
Vice Chairman

PACIFICORP

By:
Its: PRESIDENT, INTERWEST MINING CO.

RILDA CANYON ROAD IMPROVEMENT PROJECT

PRELIMINARY COST ESTIMATE 6-29-2004

ITEM	SECTION	WORK OR MATERIAL	UNIT	QUANTITY	UNIT PRICE	AMOUNT
1		MOBILIZATION	L.S.	1	$49,840.00	$49,840.00
2		CLEAR AND GRUB	L.S.	1	$15,000.00	$15,000.00
3		ROADWAY EXCAVATION	C.Y.	35,000	$4.00	$140,000.00
4		ROCK EXCAVATION	C.Y.	14,000	$8.00	$112,000.00
5		GRANULAR BORROW	C.Y.	15,100	$6.50	$98,150.00
6		UNTREATED BASE COURSE (1" MAX)	C.Y.	1,700	$15.00	$25,500.00
7		ENZYME TREATED BASE COURSE (1" MAX)	C.Y.	7,200	$16.00	$115,200.00
8		ASPHALT CONCRETE MIX (AC-10) 3/4" MAX)	TON	10,180	$42.00	$427,560.00
9		ASPHALT CONCRETE PAVEMENT SAWING	L.F.	3,700	$1.00	$3,700.00
10		WATER PIPELINE 8" PVC CLASS 200	L.F.	2,000	$14.00	$28,000.00
11		TRAFFIC SIGNS, TYPE A-2 METAL POST TYPE 1	EACH	20	$250.00	$5,000.00
12		DELINEATORS	EACH	120	$20.00	$2,400.00
13		FLAGGING	HOUR	500	$12.00	$6,000.00
14		TRAFFIC PAINT STRIPING	GAL	80	$20.00	$1,600.00
15		18" CSP CULVERT (POLYMERIC COATING)	L.F.	30	$35.00	[illegible]

R645-301-500 ENGINEERING SECTION

APPENDIX B

♦ APPROVALS

♦Contents

MSHA APPROVAL TO DISCHARGE INTO MINE

R645-301-500 ENGINEERING SECTION

APPENDIX C

♦ENVIRONMENTAL ASSESSMENT FOR DEER CREEK MINE NORTH RILDA EXTENSION

Environmental Assessment
for
Deer Creek Mine
North Rilda Extension

Manti-La Sal National Forest
Ferron-Price Ranger District
Emery County, Utah

July 1999

Responsible Officials: Janette S. Kaiser
Forest Supervisor
Manti-La Sal National Forest

Dick Manus
Field Office Manager
Price Field Office
Bureau of Land Management

Cooperating Agency: Office of Surface Mining
Denver, Colorado

ID Team Leader: Jeffrey Wade DeFreest, PG
District Geologist, IDT Leader

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UTAH DIVISION OIL, GAS AND MINING

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CHAPTER 1
Purpose and Need

A. INTRODUCTION

This chapter presents the project proposal (proposed action), the purpose and need for the proposal, the decisions to be made, public involvement efforts (scoping), and the resulting issue identification.

The Utah Division of Oil, Gas and Mining (DOGM) received a proposal from Energy West Deer Creek Mine to conduct longwall mining and subsequently subside the north slope of Rilda Canyon. This permit amendment and associated revision of the resource recovery and protection plan (R2P2) are for areas within Federal coal leases U-024317, U-2810, SL-051221, and U-06039; all of which contain special coal lease stipulation # 9 from the Forest Plan. Stipulation #9 currently precludes mining that would cause the creation of hazardous conditions such as potential escarpment failure and landslides *except* at specifically approved locations. The stipulation is as follows:

> *Except at specifically approved locations, underground mining operations shall be conducted in such a manner so as to prevent surface subsidence that would: (1) cause the creation of hazardous conditions such as potential escarpment failure and landslides, (2) cause damage to existing surface structures, and (3) damage or alter the flow of perennial streams. The Lessee shall provide specific measures for the protection of escarpments, and determine corrective measures to assure that hazardous conditions are not created.*

The Forest Service, as the surface management agency, must decide whether or not to consent to approval of subsidence of the escarpments at the north slope of Rilda Canyon by the Bureau of Land Management (BLM); and consent to the DOGM approval of the associated mine plan amendment.

Since the proposal requires amendments to Federal permits and would involve effects to National Forest System lands, the Forest Service, Manti-LaSal National Forest, will be the lead agency in the analysis. The BLM is responsible for administration of Federal Coal Leases and will participate in the analysis as a joint lead agency. The Office of Surface Mining (OSM) is responsible for administration of mine permits and will participate as a cooperating agency.

The project is located in Rilda Canyon on the Ferron-Price Ranger District within the Manti Division of the Manti-LaSal National Forest (Township 16 S, Range 7 E, partial Sections 20, 21, 28, 29). A location is mapped in Appendix A.

B. PROPOSED ACTION

The proposed action is for the cooperating agencies to allow Deer Creek Mine to conduct full extraction longwall mining and subside the escarpments on the north slope of Rilda Canyon as shown in Appendix A. The Forest Service action would be to consent to the modification of the R2P2 by the BLM, and consent to the amendment of the Mining and Reclamation Plan (MRP) with the DOGM.

Development of the proposed action included economic considerations. A detailed description of the company's proposal is outlined in Chapter 2, under Alternative 2.

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UTAH DIVISION OIL, GAS AND MINING

C. PURPOSE AND NEED

The general purpose and need for this project is to accomplish the following goal of the Forest Plan: "Provide appropriate opportunities for and manage activities related to locating, leasing, development, and production of mineral and energy resources." (Forest Plan, p. III-4).

The project-specific purpose and need of the proposed action is to maximize coal recovery and extend the mine life. This purpose and need also allows the BLM to achieve maximum economic recovery of coal from the Federal Coal Leases.

D. DECISIONS TO BE MADE BY RESPONSIBLE OFFICIALS/AUTHORITY

The BLM, Price/San Rafael Field Office Manager must decide whether or not to approve the proposed amendment to the R2P2 under the Mineral Leasing Act of 1920, as amended; Coal Leasing Amendments Act of 1975; Surface Mining Control and Reclamation Act of 1977; and the Utah Coal Rules.

The Forest Supervisor, Manti-La Sal National Forest, must decide whether or not to consent to the R2P2 and resulting MRP amendment. This involves the exercising and approval/authorization as provided for in the stipulation attached to the leases.

The pending decisions must conform to the overall guidance of the Manti-La Sal National Forest Plan (1986) and its Final Environmental Impact Statement (FEIS) and the BLM's San Rafael Resource Management Plan (1992) and its FEIS. This environmental assessment tiers to the analysis decisions resulting from both EIS's which are available for review at the Ferron/Price Ranger District and the Manti-La Sal National Forest Offices and the BLM San Rafael/Price Resource Area and the Moab District Offices, respectively.

E. SCOPING

The solicitation of comments on a proposal is called scoping. The results of scoping help to identify concerns and issues about the project that will provide the main points of analysis.

Internal scoping for this project included review by various Forest Service and BLM resource specialists. External scoping consisted of notice in the Forest's *Schedule of Proposed Actions*, a Legal Notice published in the Sun Advocate (May 5th 1998), a News Release to the Sun Advocate from which an article was written about the project (May 5th, 1998), and a letter to an 18-person mailing list. Those individuals to whom letters were mailed included: Federal, State, and local governmental or land management entities; adjacent landowners and mining companies; range permittees; and others known to be potentially interested or affected. Three letters were received in response to external scoping. A letter was received from the US Fish and Wildlife Service discussing the effects of subsidence. Additionally letters of support of the project were received from the Utah Mining Association and the United Mine Workers of America. The entirety of these letters can be found in the Project Record.

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The results of scoping identified the following initial concerns.

- *Potential Rockfalls*
- *Impacts To Water Resources*
- *Impacts To Wildlife Resources*
- *Impacts To Rangeland Use*
- *Impacts To Cultural Resources*
- *Socio-Economic Impacts*

F. ISSUES

Issues represent a synthesis of concerns expressed about the project. Issues set the scope of the project analysis. The scope of the project analysis includes the proposal, modifications to the proposal, alternatives to the proposal, and disclosure of potential effects.

The results of scoping were used to define the issues for this project. Issues are identified as either key or resolved. A key issue is one that requires an alternative to the proposal for potential resolution. It is appropriate to provide a full disclosure of anticipated effects related to a key issue. A resolved issue represents a concern resolved by the proposal through minor modifications to the proposal, project design features, or management direction (i.e. laws, regulations, policies, Forest Plan Stipulations). Sometimes discussion of anticipated effects related to a resolved issue is warranted to assist the decision maker in making a reasoned and informed decision. There were no key issues identified from the proposal.

Resolved Issues

The following issues are resolved through specific characteristics of the project area and its present use, project design features and/or management requirements. Further discussion of anticipated effects related to the following resolved issues is warranted to assist the decision maker in making a reasoned and informed decision.

Rockfalls: The proposal is likely to cause rockfalls. Rockfalls could affect visual quality, safety, vegetation, and stream sedimentation. The visual quality objective for the project area is "modification"; potential rockfalls would be within the parameters of this visual quality objective. The Colorado Rockfall Simulation Program was applied to find if toppled rocks would reach the road, and the results showed none of the 10 sample paths permitted rocks to reach the canyon-bottom road. Destroyed vegetation and increased sedimentation have been found to be negligible considering the existing condition of rocky terrain. Further discussion of this issue will address recreational use of the area, the potential hazards/risk level and project design.

Water Resources: The proposal could potentially affect water resources (Water quantity, quality, wetlands/riparian habitat, and municipal water developments). There is only one known seep (no live surface water) near the eastern end of the project area on the ridge between Rilda and Mill Fork Canyons, and it is too small to be developed for a water source. The remainder of the water resource concerns will be resolved through application of the existing coal lease stipulations and monitoring discussed in the description of the proposal in Chapter 2 and further

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Utah Division Oil, Gas And Mining

discussed in Chapter 4. The North Emery Water Users Association spring development is outside of the project area and lies topographically and stratigraphically below the proposed project as well. It is discussed further in Chapter 3.

Wildlife Resources: The proposal could affect wildlife resources (elk and deer and their habitat , raptor habitat/nesting, threatened species, endangered species, and sensitive species).

Elk and Deer - Elk and deer use the ridge top and valley bottoms throughout the project as transitional range between summer and winter range. Subsidence and potential escarpment failure is not likely to affect either population as the escarpment creates a barrier between the ridge top and valley bottom environments. Their distribution and use of the area will be further discussed in chapters 3 and 4.

Raptors - Raptor habitat is present in the escarpments of Rilda Canyon, however no currently used nests have been located in the potential escarpment failure area and cliff nesting habitat will remain available. Further discussions can be found in chapters 3 and 4.

Threatened and Endangered Species - A Biological Assessment has been completed that discloses expected effects to those species suspected to occur within the project area. A "no effect" determination has been made. (Project Record)

Sensitive Species - A Biological Evaluation has been completed describing those species that may be impacted by the project (see chapters 3 and 4). Typically the area does not contain suitable habitat for most Sensitive Species or the overall disturbance to those species and their habitat that may occur in the area is negligible. The evaluation anticipates a "no impact" to the viability of sensitive plant and most vertebrate species. (Chapter 4, Project Record)

Socio-Economic Impacts: The Deer Creek Mine currently employs 263 miners who would potentially keep their jobs longer as the North Rilda area is mined out if the action alternative is selected. Additionally, the royalties returned to the US Treasury would be increased if the action alternative is selected. These concerns are addressed throughout the analysis for comparison purposes.

The following resolved issues are resolved through project design features and management requirements and do not warrant further discussion in this document. Referenced Stipulations are included as part of this project and can be found in the Project Record.

Rangeland Use:

Sheep:
The proposal could disturb sheep grazing operations, primarily if subsidence induced cracks cause water loss to springs on the ridge between Rilda and Mill Fork Canyons. This issue is resolved because there is only one known seep on the ridge, and it is not sufficient for development or stock watering. Additionally, sheep are only occasionally pushed that far out on the ridge and are only in there 1-2 days (if at all) due to terrain and available vegetation considerations.

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UTAH DIVISION OIL, GAS AND MINING

Cattle:
As a result of the upgrading of the Rilda Canyon Road by Emery County to the "forks area" and the construction of the Deer Creek Mine surface facility , mitigation lead to installation of a cattleguard and fence, precluding the grazing use of that portion of Rilda Canyon above the springs in the northwest 1/4 of section 28. Little range use is experienced from the mouth of the canyon up to the cattle guard ai d fence, primarily only during the period that the Gentry Allotment cattle are being moved onto and off the forest.

Cultural Resources: Failure of escarpment could potentially affect significant historical properties, especially prehistoric rock shelter and/or rock art sites in escarpment locales. An archeological reconnaissance of escarpment areas was conducted in 1997. Several areas were identified as having some potential to contain cultural resources. Subsequent intensive archeological survey of the areas did not locate any archeological/historical sites. Based on this data, it was determined that the project should have no effect on historic properties. Consultation was done with the State Historic Preservation Office (SHPO) and concurrence with the "no effect" finding was made (Project Record).

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CHAPTER 2
Description of Alternatives

A. INTRODUCTION

This chapter presents the alternatives considered for implementation, features common to action alternatives, alternatives considered but not further analyzed, and a comparative summary table of the alternatives considered for implementation responding to the identified issues.

A no action alternative and an action alternative are considered in detail.

B. ALTERNATIVE DESCRIPTIONS

Alternative 1 - No Action

Forest Service would not consent to the proposed action and mining would continue under the approved R2P2 and MRP. Subsequently, the BLM would not approve the proposed amendment to the R2P2 and DOGM would not approve the corresponding mine permit amendment. Alternative 1 addresses the need to provide a "No Action" alternative (40 CFR 1502.14) and provides a benchmark for evaluating the effects of implementing the proposal. The operator would not be permitted to conduct full extraction longwall mining under the escarpment.

Though full support mining is permitted under the current mining plan, the reserves would not be economical to mine (personal communication with Chuck Semborski, Energy West Mining Co., June 1999, and George Tetreault, BLM, July 1999). No mitigation measures or monitoring would be required as part of this alternative, beyond what is already in the mining and reclamation plan.

Alternative 2 - Consent to Mining as Proposed

This alternative wholly responds to the purpose and need.

The Forest Service would consent to the modification of the R2P2 by the BLM, and consent to approval of the amendment of the Mining and Reclamation Plan by DOGM which would allow Deer Creek Mine to conduct full extraction longwall mining and subside the escarpments in the north slope of Rilda Canyon as shown in Appendix A.

Additionally, Deer Creek Mine would post warning signs at specified points in Rilda Canyon, warning recreational users of the potential rockfall hazards, as stated in their proposal. All commitments in the mining and reclamation plan would be adhered to.

The Deer Creek Mine would also monitor subsidence through their mine plan requirements and as proposed, provide higher resolution monitoring data for the north slope of Rilda Canyon by installing prisms for accurate surveying on the top of the escarpments to determine when subsidence is substantially complete.

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C. COMPARISON SUMMARY OF ALTERNATIVES

Responsiveness to Purpose and Need	Alternative 1	Alternative 2
Increased Recovery of Coal Reserve (Tons)	0	7,219,341
Extension of Mine Life	None	2 Years

Resolved Issues	Alternative 1	Alternative 2
Rockfalls:		
Escarpment Failure due to mining induced subsidence:		
Feet of Escarpment at High Risk of Failure	None	7,600
Feet of Escarpment at Moderate Risk of Failure	None	2,300
Feet of Escarpment at Low Risk of Failure	None	1,100
Modified Visual Quality Experience Potential	Low	High
Compliance to Forest Plan Visual Quality Objective	Yes	Yes
Safety Hazard/Risk	Low Risk	Low Risk
Destroyed Vegetation	None	Negligible
Increased Stream Sedimentation	None	Negligible
Water Resources:		
Risk of Water Quality/Quantity Loss	None	Negligible
Wetlands/Riparian Habitat Loss	None	Negligible
Risk To Municipal Watershed	None	Negligible
Wildlife Resources:		
Elk/Deer	No Impact	No Effect
Raptors	No Impact	No Effect
Threatened & Endangered		
Bald Eagle	No Effect	No Effect
Peregrine Falcon	No Effect	No Effect
Southwestern Willow Flycatcher	No Effect	No Effect
Sensitive Species		
Spotted Bat	No Impact	MIIH
Townsend's Big-eared Bat	No Impact	MIIH
Flammulated Owl	No Impact	No Impact
Northern Goshawk	No Impact	No Impact
Three-toed Woodpecker	No Impact	No Impact
MIIH = "May impact individuals or habitat, but will not likely contribute to a trend toward Federal listing or loss of viability to the population or species"		
Socio-Economics:		
Employment years of 263 miners	4 yrs, 5 mos.	6 yrs, 5 mos.
Royalties paid to the US Treasury	$25,658,620	$37,209,566
Rangeland Use:	No Impact	No Impact
Cultural Resources	No Impact	No Impact

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CHAPTER 3
Description of Affected Environment

A. INTRODUCTION

This chapter summarizes the resources of the affected area, with emphasis on the issue topics.

This analysis tiers to the Manti-La Sal National Forest Land and Resource Management Plan (Forest Plan) Final Environmental Impact Statement (FEIS) and Record of Decision, 1986, as amended. Relevant Forest-wide and management area goals, direction, and standards from the Forest Plan are incorporated in this analysis and are further discussed in this chapter. Additionally this analysis tiers to the BLM's San Rafael Resource Management Plan (1992) and its FEIS.

B. GEOGRAPHIC AREA

The project area is within the Huntington watershed on East Mountain. Specifically, the undermining is proposed for the ridge between Rilda and Mill Fork Canyons and the north canyon slope or escarpment of Rilda Canyon. Elevations range from approximately 7,400 feet in the canyon bottoms to 9,400 feet on top of the ridge.

The Rilda Canyon Road (FDR 50246) is under the jurisdiction of Emery County. It leaves State Highway 31 near the Forest Boundary and passes through the Rilda Canyon in a southwesterly direction. Near the fork between the Right (north) and Left (south) Forks of Rilda Canyon, the county road terminates at a turn-around, and a mine road continues up the Left Fork behind a locked gate. The mine road is closed to public vehicular traffic and is used solely by the mine for access to the South Fork Breakout on a limited basis.

C. GEOLOGY/MINERALS

Rilda Canyon is a tributary canyon to Huntington Canyon which is located on the Wasatch Plateau physiographic area. The Cretaceous Castlegate Sandstone is one of the upper members of the Mesa Verde Group and is the dominant cliff forming rock in the Rilda Canyon vicinity which forms the escarpment area where subsidence induced rockfalls would originate. It overlies the Blackhawk Formation which contains the coal beds which would be mined under the proposal. The Castlegate Sandstone ranges from 100 feet to 210 feet in thickness in the Rilda Canyon setting.

Federal Coal Leases U-024317, U-2810, SL-051221, and U-06039 are included within the northern portion of the permit area for the Deer Creek Mine. It is currently owned and operated by PacifiCorp and its subsidiary company, Energy West. Underground mining facilities within the identified leases include main entries for access within the Deer Creek Mine. There are surface facilities located in the Left Fork of Rilda Canyon, including a breakout (portal), fan, and substation. Additionally a power line was built in 1995 to support the surface facilities. Subsidence and hydrologic monitoring are being conducted under the MRP. These documents are contained in the Forest Service Project Records and can be referred to for additional information.

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Historically, the Leroy Mine, Rominger Mine, and Helco Mine operated in Rilda Canyon in the west half of Section 28. These mines were closed and reclaimed under the State of Utah, Abandoned Mine Land Reclamation programs in 1988.

Recoverable coal quantities are estimated at 23,255,979 tons in the entire project area, considering both seams are longwall mined. Mining of the two seams and expected timing are illustrated in the table below. This table assumes that full support room & pillar mining would not be economic, even though already approved in the current MRP and R2P2 (Chuck Semborski, personal communication, June 9th, 1999; George Tetreault, personal communication, July 14, 1999).

Mining Table

Seam	Recoverable Tons	Estimated Timing / Minelife
Blind Canyon		
4 Northern Panels	8,606,879	April 1999-August 2001
2 Southern Panels	3,657,598	August 2001-September 2002
Hiawatha		
4 Northern Panels	7,429,759	September 2002-October 2004
2 Southern Panels	3,561,743	October 2004-September 2005
Total	23,255,979	Area would be mined out by September 2005 if fully mined as proposed

D. WATER RESOURCES

The project area lies on a ridge dropping off of East Mountain southeasterly toward Huntington Canyon. There are perennial streams in both Rilda and Mill Fork Canyons, and scattered springs and seeps along the ridge in between. There is only a single known seep that lies on the ridge, *within the project area*. This seep does not produce enough water to warrant development for any type of use.

The North Emery Water Users Association (NEWUA) has, under Special Use Permit, a spring development for culinary water in the west 1/2 of Section 28 in the bottom of Rilda Canyon. The development including meters, valves and collection boxes is fenced to keep livestock and wildlife out of the development area. It is shown on the map in between the Leroy and Helco Mines. Additionally, a pipeline parallels the Rilda Canyon road, carrying water down-canyon from this source.

The springs are fed by the alluvial system in Rilda Creek and the majority of their recharge is from springs at the head of Rilda Canyon, west of the project area. A north-south fracture system is also thought to partially feed the NEWUA springs.

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E. WILDLIFE RESOURCES

Elk and Deer

The elk herd on East Mountain utilizes Rilda Canyon, Mill Fork Canyon and the ridge in-between as transitional range. The lower regions below the project area to Huntington Canyon provide winter range. The deer found in the project area are also part of a greater Manti herd. Deer found here are not as prevalent as the elk. Deer and elk inhabiting the project area are very important ecologically and economically. The Manti-La Sal National Forest designates deer and elk as Management Indicator Species (MIS). MIS is defined as a select group of species which can indicate change in habitat resulting from activities on the Forest (Forest Plan, p. II-31).

The project area is a moderately popular hunting site. Deer and elk within the project area provide hunting and viewing opportunities for many recreationists from around the State of Utah, similar to neighboring canyons and other areas on the forest.

Within the project area, deer and elk habitat is probably most influenced by the existence of roads which results in high human use and disturbance. Where not associated with roads, the project area contains the basic habitat elements needed by deer and elk for survival. Elk tend to avoid areas adjacent to roads having vehicle traffic, and spend more time in areas of dense cover above the forks or on the ridge between Mill Fork and Rilda Canyons.

Raptors

Raptor surveys are conducted annually as part of the Deer Creek Mine Mining and Reclamation Plan. The first surveys were conducted in 1981 and 1982, and they have been conducted annually since 1986. The most recent survey was conducted in 1998. No raptor nests were found in the area directly associated with the North Rilda lease area (project area) in the recent surveys. The surveys from the early 1980's indicated 2 golden eagle nests within the project area which can no longer be found.

Forest Service Sensitive Species

Regulatory Framework

Although not required under the Endangered Species Act, it is Forest Service policy to analyze potential impacts to Proposed and Sensitive Species (Forest Service Manual (FSM) 2670.31-32). Proposed species are those that are proposed by the US Fish and Wildlife Service to be listed as Threatened or Endangered. Sensitive Species are those identified by the Forest Service Regional Forester as, "those species for which population viability is a concern, as evidenced by significant current or predicted downward trends in population numbers or density" or "significant current or predicted downward trends in habitat capability that would reduce a species' existing distribution" (FSM 2670.5).

Plant Species

A Biological Evaluation for Sensitive species is located in the Project Record. There are seven sensitive plant species known or suspected to occur on the Manti Division (Ferron/Price and Sanpete Ranger Districts). Those species include: Creutzfeldt-flower (Cryptantha creutzfeldii), Carrington Daisy (Erigeron carringtoniae), Canyon sweetvetch (Hedysarum occidentale var. canone), Link Trail Columbine (Aquilegia flavescens var. rubicunda), Musineal Groundsel (Senecio musinensis), Maguire Campion (Silene

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petersonii), and Arizona Willow (Salix arizonica). Details concerning these species, their habitat preferences, and occurrences are described below.

Locations and General Habitat for the Sensitive Plant Species Occurring in the Ferron/Price Ranger District

District	Listed Species	Location and Habitat
Ferron/Price	**Creutzfeldt flower**	Open Mancos Shale hillside and lower slopes in dry wash and Lower Muddy Creek drainages. Elevation 5500 to 6000 ft. Pinyon, Juniper mixed Mtn. brush veg. type. Some habitat occurs in the Upper Miller Creek drainage.
Ferron/Price	**Carrington Daisy**	Small isolated populations have been found mostly on Flagstaff limestone outcrops, at the head of Cove Creek top of East Mtn., south Rim of Heliotrope Mtn., and top of Ferron Mtn. Wind blown ridge top and snow drift sites. Elevation 9,000 to 11,000 ft. Low forb vegetation type.
Ferron/Price	**Canyon sweetvetch**	Scattered populations occur in lower Huntington Canyon, Straight Canyon, and near Joe's Valley. Plants are usually found on sites with a high water table, near springs or along stream beds. Riparian site in Pinyon/Juniper type. River Birch and Squaw bush are plants most commonly associated with this species. Elevation 5500 to 7000 ft.
Ferron/Price	**Link Trail Columbine**	"Link Canyon Columbine". This plant occurs in seeps and wet sites. Populations found in Link Canyon, Box Canyon, Muddy Creek drainage, Straight Canyon, and Joes Valley.
Ferron/Price & Sanpete	**Musineal Groundsel**	The Musinea Groundsel preferred habitat is rock talus and slide rock sites near snow drifts in Flagstaff Limestone formation. Population sites located on White Mountain, Heliotrope Mtn., High Top and Camel Rock, head of 12-Mile Canyon.
Ferron/Price & Sanpete	**Maguire Campion**	Scattered populations found mostly on Flagstaff limestone formation outcrops on high elevation ridges and snowdrift sites. From Wagon Road Ridge south to the top of White Mtn., Wasatch Plateau, Manti-La Sal National Forest. There is also a small population on Mt. Baldy and Black Mtn. Plant is part of the sub-alpine low forb plant community.
Ferron/Price	**Arizona Willow**	Arizona Willow requires a specific habitat that occurs as narrow strips along perennials streams around meadows and is dominated by mesic graminoids and mesic forbs. Elevation 8,990 to 10,500 ft. One population has been found on the Manti-La Sal N.F., Upper Beaver Creek, Muddy Creek drainage.

There are no known Forest Service Sensitive plant species within the project area. Except for Canyon sweetvetch, there is no known habitat for Forest Service sensitive plant species within the project area. Canyon sweetvetch habitat is found at the base of the slopes where springs or seeps occur and along the streambed. Habitat for the other sensitive plant species is not existent.

Vertebrate Species

A Biological Evaluation for Sensitive species is located in the Project Record. There are five vertebrate sensitive species known or suspected to occur on the Manti Division: Spotted Bat (Euderma maculatum), Townsend's Big-eared Bat (Plecotus townsendii), Flammulated Owl (Otus flammeolus), Northern Goshawk (Accipiter gentilis), and Three-toed Woodpecker (Picoides tridactylus).

Spotted Bat Habitat - Spotted bats occur in scattered areas throughout Utah. They have been found in a variety of habitat types including open ponderosa pine, desert scrub, pinyon-juniper, and open pasture and hay fields. They roost alone in rock crevices high up on steep cliff faces. Cracks and crevices ranging in width from 0.8-2.2 inches in limestone or sandstone cliffs are critical roosting sites. There is some evidence that individuals show fidelity to roost sites. They are territorial and avoid each other while foraging. They are thought to migrate south for winter hibernation. Spotted bats are rare and may

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be limited by suitable roosting sites. They are found in relatively remote, undisturbed areas, suggesting that they may be sensitive to human disturbance. Little is known of the spotted bat's food habits, they are thought to feed mainly on moths. They forage alone, after dark, and avoid each other by listening to the echolocation calls of others. (Leonard and Fenton, 1983; Woodsworth et. al., 1981; Watkins, 1977)

In the summer of 1997, surveys conducted by Genwal Resources Incorporated detected spotted bats using habitats within Mill Fork Canyon, Crandall Canyon, Biddlecome Hollow, Tie Fork, Huntington Canyon, and Bear Creek Canyon. Foraging areas were located at relatively low elevation sites associated with riparian vegetation with Huntington Canyon. Specific individual roost sites were not located, general roosting areas were identified on the cliff faces/rock outcrops in Crandall and Mill Fork Canyons. Additional roosting areas were identified throughout the Huntington Canyon drainage among sizeable cliff faces (Johanson, Rogers and Sherwin, 1997). Known observations of spotted bats on the Wasatch Plateau have been made at Joes Valley Reservoir and at Emerald Lake.

Spotted bat foraging and roosting habitat can be found throughout the Wasatch Plateau, mainly associated with riparian areas and steep rock/cliff outcrops. Evidence of bats, the species is unknown, was observed in the project area in the form of bat guano at isolated locations along the rock escarpment. Any spotted bats present would primarily use the escarpment for roosting and adjacent riparian area for foraging purposes.

Townsend's Big-Eared Bat (Western Big-Eared Bat) Habitat - Townsend's or Western Big-eared bats use a variety of scrub and forested habitats, throughout western North America. These bats use juniper/pine forest, shrub/steppe grasslands, deciduous forests and mixed coniferous forests from sea level to 10,000 feet elevation. They utilize colonial nurseries. Cool places such as caves, rock fissures, mines, and buildings are used for roosting and hibernation. Foraging on primarily moths is often done in open woodlands, along forest edges, and over water.

The Townsend's Big-eared bat occurs throughout western North America including Utah. During the winter they roost singly or in small clusters. They remain at these sites from October to February. Migration for these bats usually means a change in location in the same cave or to another nearby cave. The Townsend's Big-eared bat is very sensitive to human disturbance. It will readily abandon roosts when disturbed. (Kunz an Martin, 1982; Utah Division of Wildlife Resources, 1980).

In the summer of 1997, bat surveys were conducted by Genwal Resources Incorporated in areas within Huntington Canyon (Crandall Canyon, Biddlecome Hollow, Tie Fork, Huntington Canyon, Mill Fork, and Bear Creek Canyon). No Townsend's Big-eared bats were located in those areas.

In 1992, Townsend's Big-eared bats were found using inactive coal mines as hibernacula on the Ferron/Price Ranger District. They have also been found roosting in buildings of the Ferron/Price Ranger District in the town of Ferron during late summer of 1992.

Townsend's Big-eared bat foraging and roosting habitat can be found throughout the Wasatch Plateau, mainly associated with riparian areas and steep rock/cliff outcrops. Evidence of bats, the species is unknown, was observed in the project area in the form of bat guano at isolated locations along the rock escarpment. Any Townsend's Big-eared bats present would primarily use the adjacent riparian area for foraging purposes.

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Flammulated Owl Habitat - Flammulated owls are found throughout the western United States including Utah. They can be found in the mixed pine forests, from pine mixed with oak and pinyon at lower elevations to pine mixed with spruce and fir at higher elevations. They have also been found in aspen and second growth ponderosa pine, however, they prefer mature Ponderosa Pine-Douglas fir forests with open canopies. Large diameter dead trees with cavities are important nest site characteristics. They avoid foraging in young dense stands where hunting is difficult. Flammulated owls are dependant upon mature conifer stands for nesting. They are also known to avoid cut-over areas. Flammulated owls are almost exclusively insectivorous, preying on small to medium sized moths, beetles, caterpillars, and crickets (Reynolds and Linkhart, 1987; Johnsgard, 1988; Bull et. al., 1990).

Flammulated owls have been found in the Quitchupah drainage and the head of the Muddy Drainage on the Ferron/Price Ranger District. All but one of these locations have been associated with ponderosa pine.

Northern Goshawk Habitat - In nesting or foraging, the goshawk is a raptor of the dense forest. Goshawks have been found in a variety of forest ecosystems including lodgepole pine, ponderosa pine, Douglas-fir, mixed forest throughout much of the Northern hemisphere. They prey upon small mammals and birds (rabbits, squirrels, chipmunks, grouse, woodpeckers, jays, robins, grosebeaks, etc.). Goshawk nest sites are usually located in mature forests near water, and on benches of relatively little slope. Nests are often used year after year. Goshawks are very protective of their young in the nest and loudly defend them to intruders. They are very sensitive to human disturbance and have abandoned nests and young due to human activities that take place too close to their nest (Kennedy and Stahlecker, 1989; Hennessey, 1978).

The goshawk is a summer resident of the Wasatch Plateau and the number of nesting birds vary year to year. Nest sites are associated with aspen/mixed conifer, mixed conifer forest types. Habitat for the goshawk is marginal since the area of impact is mostly pinyon-juniper which doesn't provide good foraging or nesting areas.

Three-Toed Woodpecker Habitat - Three-toed woodpeekers range across North America. They are found in northern coniferous and mixed forest types up to 9000 feet elevation. Forests containing spruce, grand fir, ponderosa pine, tamarack, and lodgepole pine are used by Three-toed woodpeckers for foraging and nesting. Nests may be found in spruce, tamarack, pine cedar, and aspen trees. Three-toed woodpeckers forage mainly in dead trees, although they will feed in live trees. About 75% of their diet is wood-boring beetle larvae, but they also eat moth larvae. They are major predators of the spruce bark beetle, especially during epidemics. Fire or insect-killed trees are major foraging areas. Forest fires and areas of insect outbreaks may lead to local increases in woodpecker numbers after 3-5 years (Bull et. al., 1986; Scott et. al., 1980).

Surveys for three-toed woodpeckers took place in suitable habitat on the Wasatch Plateau in June and July of 1992. Further surveys during the 1993, 1994, 1995, and 1996 field seasons on the Plateau resulted in additional three-toed woodpecker findings. This species was found on all Ranger Districts surveyed. Three-toed woodpeckers habitat is marginal in the area of impact is mostly pinyon-juniper. The presence of tree mortality from insects is limited to isolated trees rather than the epidemic that is found in other areas of the forest.

* References cited for sensitive species can be found in the Biological Evaluation prepared for this project (Project Record).

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Federally Listed Proposed Species

There are no known US Fish and Wildlife Service Proposed plant or vertebrate species within the project area (US Fish and Wildlife Service list January 7, 1998).

Federally Listed Threatened And Endangered Species

Federal agencies are mandated to analyze effects of proposed projects on Threatened and Endangered species according to the Endangered Species Acts. A Biological Assessment for Threatened and Endangered species is located in the Project Record. Species potentially impacted by the project include:

Species	Classification
Bald Eagle (Haliaeetus leucocephalus)	Threatened
Peregrine Falcon (Falco peregrinus anatum)	Endangered
Colorado Squawfish (Ptychocheilus lucius)	Endangered
Bonytail Chub (Gila elegans)	Endangered
Humpback Chub (Gila cypha)	Endangered
Razorback Sucker (Xyrauchen texancus)	Endangered
Southwestern Willow Flycatcher (Empidonax traillii extimus)	Endangered

* The above species list were derived from a U.S. Fish and Wildlife Service (USFWS) list of threatened, endangered and proposed species that may be present in the general Wasatch Plateau area (List received 1998)

Bald Eagles Habitat

During the breeding season bald eagles are closely associated with water, along coasts, lake shores, or river banks. During the winter bald eagles tend to concentrate wherever food is available, this usually means open water where fish and waterfowl can be caught. They also winter on more upland areas feeding on small mammals and deer carrion. At winter areas, bald eagles commonly roost in large groups. These communal roosts are located in forested stands that provide protection from harsh weather.

Bald eagles can often be found near lakes and reservoirs as well as upland areas on the Manti Division during the late fall and early winter. When lakes and reservoirs freeze over most eagles will leave, however, those feeding in upland areas may stay late into the winter. A pair of nesting bald eagles has recently been located ten miles east of the Forest boundary near the town of Castle Dale. In 1994, a review of the nesting adults and fledglings indicated their foraging habits were within five mile radius from the nest tree. The eagles were not observed inhabiting the analysis area (Boshen, 1995). No bald eagles are known to nest on the forest.

Peregrine Falcon Habitat

Peregrines occupy a wide range of habitats. They are typically found in open country near rivers, marshes, and coasts. Cliffs are preferred nesting sites, although peregrines now regularly nest on man-made structures such as towers and high-rise buildings. Peregrines are known to travel more than 18

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miles from the nest site to hunt for food. However, a 10 mile radius around the nest is an average hunting area, with 80 percent of the foraging occurring within a mile of the nest. Peregrines prey on wide variety of birds including shorebirds, waterfowl, grouse, and pigeons (Ratcliffe 1980; and Cade et al. 1988). Migrating or transient peregrines have been seen on the Wasatch Plateau, including Joes Valley.

On April 10, 1996 a helicopter survey conducted by the Utah Division of Wildlife Resources in cooperation with the PacifiCorp, Bureau of Land Management (BLM) and U.S. Forest Service (USFS) found a pair of falcons. The falcons have been observed several times since then from the ground. This is an expansion of the falcon into a new breeding territory and the first observation of breeding falcons in the Manti Division. The falcons have been observed showing breeding behavior including; copulating, driving golden eagles from the area, and exploration of ledges for egg laying. This pair is located approximately 10 miles south of the project area. A peregrine falcon has been seen in the project area, the bird probably uses the general area for foraging but no nesting sites are known to occur in the project area. Annual raptor flights will be done in conjunction with PacifiCorp and the UDWR.

Colorado Squawfish Habitat

The Colorado squawfish had a historic range from Green River, Wyoming, to the Gulf of California, but the species is now confined to the upper Colorado River Basin mainstream and larger tributaries (USFWS 1987a). The lower Green River between the Price and San Rafael rivers contains abundant Colorado Squawfish (USFWS 1987b). In general, the species decline can be attributed to direct loss of habitat, changes in water flow and temperature, blockage of migrations, and interactions with introduced fish species (USFWS 1987b). Colorado squawfish adults are thought to prefer deep water eddies and pools or other areas adjacent to the main water current, whereas the young inhabit shallow, quiet backwaters adjacent to high flow areas. Colorado squawfish feed on invertebrates while young but gradually move to preying on other fish after one year (Woodling 1985). No Colorado squawfish have been located on the Forest but they are present in the drainages that receive water originating on the Forest.

Bonytail Chub Habitat

Historically bonytail chubs existed throughout the Colorado River drainage (Woodling 1985). Recently, isolated captures of bonytail chubs have been made in the Colorado River basin but recruitment to the population is extremely low or nonexistent. The decline of the bonytail chub is attributed to dam construction and associated water temperature changes. Other factors contributing to the reduced numbers include flow depletion, hybridization, stream alterations associated with dam construction, and the introduction of non-native fish species. The bonytail chub generally inhabits eddies and pools over swift current areas (Woodling 1985). The chub is an omnivore, feeding mostly on terrestrial insects, plant debris and algae and begins to spawn at five to seven years of age (Behnke and Benson 1980).

No bonytail chubs have been located on the forest but they are present in drainages that receive water originating on the Forest.

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Humpback Chub Habitat

The humpback chub is believed to have inhabited all of the large rivers of the upper Colorado River basin and canyons of the lower Colorado River basin (Ono, Williams, and Wagner 1983). Presently the humpback chub can be located in and above the Grand Canyon, Arizona, and the major tributaries to the Colorado River (Woodling 1985) The USFWS (1990) cites stream alteration, including dewatering, and dams and channelization, as factors causing the decline of the species. The humpback chub normally lives adjacent to high velocity flows, where they consume plankton and small invertebrates (USFWS 1990). The humpback chub has not been located on the Forest but they are present in drainages that receive water originating on the Forest.

Razorback Sucker Habitat

Historic distribution of the razorback sucker was mainly along the mainstream of the Colorado, Green and San Juan Rivers. They presently only occur in a portion of their former range in these rivers and are normally found in water four to ten feet deep within areas of strong currents and backwaters (Woodling 1985). Spawning fish have been located over both sand and gravel/cobble bars (USFWS 1987b). The razor back sucker feeds on small invertebrates, and animals and organic debris on the river bottoms. Behnke and Benson (1980) link the decline of the razorback sucker to the land and water uses, particularly dam construction and the associated change of flow regimes and river channel characteristics. The razorback sucker has not been located on the Forest but they are present in drainages that receive water originating on the Forest.

Southwestern Willow Flycatcher Habitat

The Southwestern willow flycatcher (SWWF) spends most of its time in the southwestern United States and may be extending its range to the lower one/fourth of the state of Utah. These flycatchers are closely associated with riparian habitats, on the shores of ponds, or bordering marshy areas. They are also found in the brushy margins of fields, along mountain streams, and in shrubby floodplain areas. They prefer areas of high shrub densities interspersed with openings or meadows. The woody component of their habitat is almost exclusively deciduous including willows, alders, cottonwoods, aspens, and shrubs such as chokecherry, hawthorn, sumac and wild rose. As the name implies Southwestern Willow Flycatchers are insectivores eating wasps, bees, beetles, flies, moths and butterflies (Unitt 1987). Willow flycatchers have been found on the Wasatch Plateau, however at the present time it is uncertain if they are SWWF or Northern Flycatchers. Riparian vegetation is present in proximity to the project area but will not be affected by the operation.

* References cited for Threatened or Endangered species can be found in the Biological Assessment prepared for this project (Project Record).

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F. RECREATIONAL OPPORTUNITIES AND USE

Current Opportunities and Use

The project area has only one primary road up Rilda Canyon, which terminates near the forks of the canyon in Section 29. A mine road continues up the Left Fork to the surface facilities and a former drill road, now converted to a trail (Trail No. 395), continues up the Right Fork approximately 1.5 miles. This trail does not connect to a trail system, and is considered a "dead-end" trail. Both trail and road are used lightly during the summer and early autumn months . Light use of undeveloped campsites along Rilda Creek/Rilda Canyon Road is experienced during the summer months.

Visual Quality

The characteristic landform of this area is steep narrow canyons of major escarpments. Flowing parallel to the Rilda Canyon Road is Rilda Creek which has entrenched this particular canyon. This perennial stream is bordered by a narrow riparian corridor interspersed with cottonwoods. Thin rocky soils and a relatively arid climate have resulted in an open, primarily pinyon-juniper community established mostly on the less steep slopes above the creek. These coarsely textured/vegetated slopes end abruptly at the base of the dominating Castlegate Sandstone outcrop. Soil colors are light brown to tan, consistent with this eroding parent sandstone material above.

The Forest Plan has assigned a Visual Quality Objective to each area of the Forest reflecting the desired management emphasis of the specific area. Some of those objectives assigned allow a noticeable degree of change. This flexibility was incorporated into the Forest Plan to facilitate Forest management goals.

The term Visual Quality Objective refers to the degree of acceptable visual alteration of the landscape and may be defined as follows: A desired level of scenic excellence based on physical and sociological characteristics of an area. Typically, more stringent VQO's are incorporated to protect the most highly visible and most frequently seen areas that have the greatest amount of variety in vegetation and other features which occur naturally.

After comparing the specific limits of the project area with the Forest Plan visual quality map, it was determined that any area of potential visual impact has been designated as Modification, on Forest Service lands.

Under the VQO of Modification, management activities may visually dominate the original characteristic landscape. However, activities of vegetative and landform alteration must borrow from naturally established form, line, color, or texture so completely and at such a scale that its visual characteristics are those of natural occurrences within the surrounding area or character type. Additional parts of these activities such as structures and roads must remain visually subordinate to the proposed composition. Reduction in form, line, color, and texture should generally be accomplished in the first year. In summary; this broad objective allows for most forms of management activity including those which are visually obtrusive, however the activity (especially associated roads and structures) must be designed to fit the context of the natural surroundings.

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G. RANGELAND USE

The project area falls within the Gentry Cattle and Horse Allotment (canyon bottoms) and the Crandall Ridge Sheep and Goat Allotment (ridge between Mill Fork and Rilda Canyons).

As a result of the upgrading of the Rilda Canyon Road by Emery County to the forks and the construction of the Deer Creek Mine surface facility, wildlife mitigation lead to installation of a cattleguard and fence, precluding the grazing use of that portion of Rilda Canyon above the springs in the northwest 1/4 of section Little range use is experienced from the mouth of the canyon up to the cattle guard and fence, primarily only during the period that the Gentry Allotment cattle are being moved onto and off from the forest.

The Crandall Ridge Sheep and Goat Allotment typically has 1032 sheep that graze the allotment overall. Few if any sheep are pushed out to the end of the ridge between Rilda and Mill Fork Canyons above the project area. These few sheep spend only 1 to 2 days there due to the lack of water and difficult access.

H. CULTURAL RESOURCES

An archeological reconnaissance of escarpment areas was conducted in 1997. Several areas were identified as having some potential to contain cultural resources. Subsequent, intensive archeological survey of the areas did not locate any archeological/historical sites. Based on these data it was determined that the project should have no effect on historic properties. Consultation was done with the State Historic Preservation Office (SHPO) and concurrence with the "no effect" finding was made (Project Record).

I. SOCIO-ECONOMICS

The Deer Creek Mine currently directly employs 263 people and contributes to jobs in related support industries in the surrounding communities and states. The mine provides coal for the Huntington Power plant which in turn supplies electricity for PacifiCorp's power grid. Lastly, the coal mined on the federal leases generates royalties for the US Treasury, which are further distributed to State and Local governments.

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CHAPTER 4
Environmental Consequences

A. INTRODUCTION

This chapter identifies the projected impacts from implementing the no action and the action alternative considered in detail, presented in Chapter 1. This chapter discloses both the potential direct/indirect effects and cumulative impacts. Direct/indirect effects are those effects that would likely occur during or shortly after implementation of a specific alternative. Direct/indirect effects are presented by resource topic corresponding to the issues identified in Chapter 2. Cumulative impacts are those effects which may occur with implementation of an alternative combined with other past, present, or reasonably foreseeable actions.

The effects of the mining operation were assessed in the Environmental Assessments for Federal Coal Leases U-024317, U-2810, SL-051221, and U-06039, and any subsequent readjustments. These documents discuss the existing and potential effects from surface facilities and mining induced subsidence. These analyses were done assuming conventional, room and pillar mining operations under the escarpments however. No subsidence of the escarpment was to be authorized without additional analysis, as stipulated in the lease. Mining operations were permitted and are regulated under the Utah Coal Rules and associated Federal and State regulations and programs. Facilities have been designed and constructed in accordance with required standards. Below, each alternative is analyzed relative to the elements developed from the issues for this environmental assessment.

B. DIRECT & INDIRECT EFFECTS OF ALTERNATIVE IMPLEMENTATION

RESPONSIVENESS TO PURPOSE & NEED:

Alternative 1

Approximately 16,036,638 would be mined from the previously permitted northern four panels in both Blind Canyon and Hiawatha Seams. About 7,219,341 tons of potentially recoverable coal reserves in the southern two panels of each seam would not be recovered due to surface resource concerns. By not being permitted to mine the two seams of the two southern panels, the life of the mine would be shortened by 2 years overall (ending about September 2003 rather than September 2005). Full support room & pillar mining of the 2 southern panels in each seam would not be economic, even though already approved in the current MRP and R2P2 (Chuck Semborski, personal communication, June 9th, 1999; George Tetreault, BLM, July 14, 1999).

Alternative 2

Approximately 23,255,979 tons of recoverable coal would be mined, and the life of the mine would be extended by 2 years, with operations finishing up in September 2005.

ISSUES:

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Rockfalls:

Alternative 1

Under the "no Action" alternative, the Forest Service would not consent to the amendment of the R2P2 and the subsequent mine plan modification and the subsequent permits would not be amended as proposed by the responsible agencies. Mining induced subsidence would not be permitted and therefore there would be no mining induced failure. Natural rockslides would continue to occur at a slow rate; continually modifying the scenery (visual quality), altering vegetation, contributing to sedimentation and potentially creating hazardous conditions for public users.

Alternative 2

Under the action alternative, the Forest Service would consent to the amendment of the R2P2 and the subsequent mine plan modification. Mining induced subsidence would be permitted and mining induced failure of parts of the escarpment would be expected. Natural rockslides would also continue to occur.

An analysis conducted by Maleki Technologies Inc. studied the Castlegate Escarpment in the project area and divided the approximately 11,000 feet of exposure into 110 cells and through data collection and modeling, established a risk of failure for each cell; low, moderate and high. Of the 110 cells analyzed (each approximately 100 feet long), 11 were shown to have a low potential of failure due to mining induced subsidence. Moderate potential of failure was assigned to 23 of the cells, and a high potential of failure was assigned to 76 cells, or about 69% of the total escarpment length in the project area.

These rockfalls, as seen from within Rilda Canyon, would appear similar to naturally occurring rockfalls in the vicinity, except that the linear scale would be substantially greater. As noted above, 69% of the escarpment, or approximately 7,600 feet, falls in the "high potential of failure" category. It is expected that much of that 7,600 feet of escarpment would experience some degree of rock falls or rockslides, forming fresh-looking rock faces and talus slopes.

The Maleki study predicted the potential for failure based on data collected at Newberry Canyon, Cottonwood Canyon (Trail Mountain Mine), and the geology in Rilda Canyon, including comparison of joint patterns and direction of mine panel orientation. The Maleki study suggested that the areas most susceptible to failure were concave portions of the escarpment. Prominences, jutting outward into the canyons, were not as likely to fail, or at least not to the same degree.

Escarpment failure could visually affect lands within the reaches of upper Rilda Canyon. This potential visual effect is predicted to be consistent with other common naturally occurring failures viewed throughout this and all other similarly formed canyons. Accordingly, noticeable visual effect to the casual Forest visitor will fall well within the parameters outlined for the VQO of Modification.

The project area lies out of sight of Highway 31, being located approximately 2 miles up Rilda Canyon. The visual effect of escarpment failure on the public at large is anticipated to be negligible.

The Colorado Rockfall Simulation Program (CRSP) and the support data provided by PacifiCorp does not show any rockfall reaching the Rilda Canyon Road. The proposal commits to the installation of warning signs to further minimize any risk to safety.

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The CRSP was originally calibrated in PacifiCorp's analysis to a failure in similar geology and terrain in nearby Newberry Canyon, associated with their Cottonwood-Wilberg Mine complex. As part of their analysis, they observed the material of the Castlegate Sandstone that had failed and then modeled it to see what size material might be expected to fail in the subject mine plan amendment area.

Later the model was applied to the Trail Mountain Mine, mining of 4th and 5th east longwall panels, also undermining the Castlegate Sandstone, in a similar geologic terrain. The model proved to be accurate.

Given the low recreational use of this canyon, the results of the CRSP, and the voluntary proposal by the Deer Creek Mine to place signs warning of potential rockfall hazards along the Rilda Canyon road, there is negligible threat to public safety anticipated.

The Deer Creek Mine will also monitor subsidence through their mine plan requirements and as proposed, provide higher resolution monitoring data for the north slope of Rilda Canyon by installing prisms for accurate surveying on the top of the escarpments.

There is potential for temporary loss of vegetation on the sparsely vegetated slopes of Rilda Canyon due to rockfalls and slides, and a minimal increase in sediment production. The rock exposure on the north slope and naturally occurring sedimentation is already present. The failure of escarpment would merely accelerate the process, until revegetated.

COMPARISON OF DIRECT EFFECTS

Disturbance	Alternative 1	Alternative 2
Escarpment At Risk Of Failure Due To Mining		
High Risk	**0**	**7,600 feet**
Moderate Risk	**0**	**2,300 feet**
Low Risk	**0**	**1,100 feet**
Recoverable Tons of Coal	**16,036,638**	**23,255,979**
Life of Mine	**4 yrs. 5 mos.**	**6 yrs. 5 mos.**

Water Resources:

Alternative 1

Under the "No Action" alternative, the Forest Service would not consent to the amendment of the R2P2 and the subsequent mine plan modification. Mining induced subsidence would not be permitted and therefore there would be no mining induced failure.

The north-south fracture system thought to be partially feeding the NEWUA springs could be altered by full support mining authorized by the current MRP and R2P2.

Natural rockslides would continue to occur continually altering vegetation and contributing to erosion and sedimentation.

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Alternative 2

As discussed in the Rockfalls section above, there is a high probability of escarpment failure, however, the CRSP results illustrate that rockfalls would not cause a safety hazard as far as the road. It follows that the potential for rocks and debris traveling further to threaten the spring development facilities and Rilda Creek is even less likely. However, accelerated erosion associated with the 7600 feet of rockfall/escarpment failure could increase sediment in the Rilda Canyon/Huntington Canyon drainages.

Any unforeseen damage to permitted facilities on National Forest System lands would be required to be repaired under the existing lease stipulations. Likewise, water loss (quality or quantity) would require replacement, and damages done to stream and riparian environments would also be repaired by the mine under their existing mining and reclamation plan.

The north-south fracture system thought to be partially feeding the NEWUA springs could be altered by full support mining authorized by the current MRP and R2P2 or by the action alternative allowing longwall mining and subsequent subsidence.

The seep on the ridge could be altered as a result of mining and subsidence leading to corresponding vegetation changes.

Wildlife Resources:

Alternative 1

Under the "No Action" alternative, the Forest Service would not consent to the amendment of the R2P2 and the subsequent mine plan modification. Mining induced subsidence would not be permitted and therefore there would be no mining induced failure affecting the wildlife resources.

Alternative 2

Elk and Deer

This alternative could temporarily increase animal stress, causing displacement, and in rare isolated instances mortality. In the short term, mining disturbance could displace localized individual deer and elk populations that tend to move through the area below the escarpment area, in the bottom of the valley.

Raptors

Mining-induced subsidence would be permitted and therefore potential for escarpment failure would be likely, potential nesting habitat would be lost for raptors. There are currently no nests on the Rilda Canyon escarpment proposed to be mined, though two old nest sites had been previously identified in the Deer Creek Mine Mining and Reclamation Plan. These nests are now abandoned/dilapidated or gone entirely. Raptor surveys are conducted annually as part of the Deer Creek Mine Mining and Reclamation Plan, PacifiCorp conducts a helicopter raptor survey with the Utah Division of Wildlife Resources as observers. The first surveys were conducted in 1981 and 1982, and they have been conducted annually since 1986. The most recent survey was conducted in 1998. No raptor nests were found in the area directly associated with the North Rilda lease area (project area).

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Raptors are known to reside in the vicinity of Rilda and Mill Fork Canyons. Though they have not been nesting in the project area, there are nests located on the south slope escarpments in Rilda Canyon, and elsewhere in the area. These individuals would continue undisturbed in the area under this alternative.

If a raptor moves into and nests upon escarpment in the project area, consultation with the Utah Division of Wildlife Resources will be initiated. If the raptor is a Threatened or Endangered species the US Fish and Wildlife Service (USFWS) will also be notified and consulted prior to proceeding with mining that would cause loss of the new nest(s).

Sensitive Species

Six sensitive species have been evaluated for potential impacts. The species are listed below with the impact potential.

SPOTTED BAT ***(Euderma maculatum)***

There is a potential impact to the spotted bat. The bats' roosting habitat is located on mountain side slopes in cracks and crevices in rock outcrops and escarpments. The area has a high potential of an escarpment failure that would remove some roosting habitat, and potentially result in the loss of individual bats. A past inventory (1997) conducted by Genwal Resources Incorporated detected spotted bats using habitats within Mill Fork Canyon, Crandall Canyon, Biddlecome Hollow, Tie Fork, Huntington Canyon, and Bear Creek Canyon (these areas are adjacent to Rilda Canyon). Foraging areas were located at relatively low elevation sites associated with riparian vegetation with Huntington Canyon. Spotted bat foraging and roosting habitat can be found throughout the Wasatch Plateau, mainly associated with riparian areas and steep rock/cliff outcrops. Roosting habitat associated with this project will be impacted if the escarpments fail due to the mining activity or natural rockslides. Evidence of bats, the species is unknown, was observed in the form of bat guano at isolated locations along the rock escarpment in Rilda Canyon. Any spotted bats present would primarily use the adjacent riparian area for foraging purposes.

TOWNSEND'S BIG-EARED BAT ***(Plecotus townsendii)***

There is a potential impact to the Townsend Big-eared bat. The bats roosting habitat is located on mountain side slopes in cracks and crevices in rock outcrops and escarpments, caves and buildings. The area has a high potential of an escarpment failure that would remove some roosting habitat, and potentially result in the loss of individual bats. A past inventory (1997) conducted by Genwal Resources Incorporated failed to detect any Townsend Big-eared bats. Surveys were done in Mill Fork Canyon, Crandall Canyon, Biddlecome Hollow, Tie Fork, Huntington Canyon, and Bear Creek Canyon (these areas are adjacent to Rilda Canyon). Roosting habitat associated with this project will be impacted if the escarpments fail due to the mining activity or natural rockslides. Evidence of bats, the species is unknown, was observed in the form of bat guano at isolated locations along the rock escarpment in Rilda Canyon. Any bats present would primarily use the adjacent riparian area for foraging purposes.

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FLAMMULATED OWL *(Otus flammeolus)*

No flammulated owl surveys have been conducted within the project area, this area provides only marginally suitable habitat for this species. If flammulated owls exits here they are most likely at very low population levels. No direct or indirect effects are anticipated.

NORTHERN GOSHAWK *(Accipiter gentilis)*

Wildlife surveys have located several active goshawk nests on the Wasatch Plateau, however none were found in the project area. The project area contains primarily pinyon-juniper and does not provide the habitat preferred by the goshawk. No direct or indirect effects are anticipated to this species.

THREE-TOED WOODPECKER *(Picoides tridactylus)*

If Three-toed woodpeckers exist here they are most likely at very low population levels. The project area contains primarily pinyon-juniper and does not provide the habitat preferred by the Three-toed woodpeckers. No direct or indirect effects are anticipated.

CANYON SWEETVETCH *(Hedysarum occidentale var. canone)*

Habitat is found at the base of the slopes where springs or seeps are found and along the streambed. The bottom of the canyon where the habitat exists is not proposed to be subsided. This species was seeded in the potential habitat but the species did not persist. The plant will not be affected by this action.

SUMMARY OF EFFECTS FOR SENSITIVE SPECIES

SPECIES	ALT 1	ALT 2
Spotted bat	No Impact	MIIH
Townsend's big-eared bat	No Impact	MIIH
Flammulated owl	No Impact	No Impact
Northern Goshawk	No Impact	No Impact
Three-toed woodpecker	No Impact	No Impact
Canyon Sweetvetch	No Impact	No Impact

MIIH = May Impact Individuals Or Habitat, But Will Not Likely Contribute To A Trend Towards Federal Listing Or Loss Of Viability To The Population Or Species.

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Threatened & Endangered Species

Suitable Habitat

The area affected by the proposed action does not contain suitable habitat (i.e. elevation, vegetation, and/or geology) and known home ranges for many of the Threatened or Endangered species. Therefore, it is determined that there will be no effect upon them. These species (as listed below) are therefore eliminated from further analysis.

* Colorado Squawfish (**Ptychocheilus lucius**) - The endangered fish species of the Colorado River occur in waterways more than 100 miles away from the proposed action. The proposed action is not expected to cause any measurable changes in sediment yields or water flow into the Colorado River Drainage.

* Bonytail Chub (**Gila elegans**) - The endangered fish species of the Colorado River occur in waterways more than 100 miles away from the proposed action. The proposed action is not expected to cause any measurable changes in sediment yields or water flow into the Colorado River Drainage.

* Humpback Chub (**Gila cypha**) - The endangered fish species of the Colorado River occur in waterways more than 100 miles away from the proposed action. The proposed action is not expected to cause any measurable changes in sediment yields or water flow into the Colorado River Drainage.

* Razorback Sucker (**Xyrauchen texancus**) - The endangered fish species of the Colorado River occur in waterways more than 100 miles away from the proposed action. The proposed action is not expected to cause any measurable changes in sediment yields or water flow into the Colorado River Drainage.

The potential for effects upon the following species will be analyzed further.
Bald Eagle (Haliaeetus leucocephalus), Peregrine falcon (Falco peregrinus anatum), Southwestern Willow Flycatcher (Empidonax traillii extimus).

Effects of the Project Proposal

Bald Eagles (**Haliaeetus leucocephalus**)

Bald Eagles can often be found near the lakes and reservoirs on the Manti Division during the late fall and early winter. Joes Valley Reservoir has been known to annually inhabit bald eagles from approximately mid October to early January. When the reservoir freezes over, the eagles leave. A pair of bald eagles have been known to nest near the town of Castle Dale (approximately 10 miles south of the proposed action). Reviews of the nesting eagles near Castle Dale indicate foraging habitat of adults and juveniles are within an approximate five mile radius from the nest site. The nesting eagles's home range was not identified to be within any of the area addressed in the Deer Creek Mine Plan Amendment. The project area has been surveyed by the U.S. Fish and Wildlife Service, Utah Division of Wildlife Resources, and local coal companies for the past thirteen years. Lately, follow-up surveys have been conducted yearly. A raptor nest was found a couple of years ago,

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however during the 1998 survey this nest could not be relocated (nests on cliffs have the tendency to be blown away after time). No direct or indirect effects caused by the mine operation are expected. No bald eagles are known to inhabit the area outside of the wintering period.

The proposed action will not contribute to loss of viability for the following reasons:

1) Bald Eagles are known not to nest or reproduce within any of the proposed action areas.
2) No bald eagles are known to utilize any of the proposed project area.
3) Reviews of the nesting bald eagles near Castle Dale indicate foraging habits of adults and juveniles are not within the proposed action areas.

Peregrine Falcon (**Falco peregrinus anatum**)

Peregrines prefer cliffs as nest sites. Existing cliff faces occur within the effected area. The Manti Division underwent intense aerial surveys for peregrine falcons. The area was surveyed by the U.S. Fish and Wildlife Service, Utah Division of Wildlife Resources, and local coal companies approximately thirteen years ago. Lately follow-up surveys have been conducted yearly, a couple of years ago a confirmed sighting of a peregrine was made in Rilda Canyon, however the bird did not establish a scrape in the area. Habitat exists throughout the general area, however no birds are known to inhabit the area besides perhaps when foraging. No direct or indirect effects caused by the mine operation are expected.

The proposed action will not contribute to loss of viability of the peregrine falcon for the following reasons:

1) Peregrine falcons have recovered to a level of approximately 160 eyries in the state of Utah. Well above the 21 active eyries set as a goal for Utah by the American Peregrine Falcon Recovery Plan.
2) No peregrine falcons are known to utilize any of the proposed project area, except perhaps in general foraging.

Southwestern Willow Flycatcher (**Empidonax traillii extimus**)

Flycatchers are closely associated with riparian habitats such as willow or alder thickets along streams, on the shores of ponds, or bordering marshy areas. They are also found in the brushy margins of fields, along mountain streams, and in shrubby floodplain areas. Willow Flycatchers have been found on the Wasatch Plateau, however at the present time it is uncertain if they are SWWF or Northern Flycatchers. Riparian vegetation is present in proximity to the proposed coal extraction site but will not be affected by the operation, the coal company has proposed to place mains that would go under the streambed (at a right angle), but would not subside this area. The mining operation should not affect the streambed so this should not impact any flycatchers, if present.

The proposed action will not contribute to loss of viability of the Southwestern Willow Flycatcher for the following reasons:

1) Flycatchers are closely associated with riparian habitats, this habitat is present in proximity to the proposed coal extraction site but will not be affected by the operation.
2) Willow flycatchers have been found on the Wasatch Plateau, however at the present time it is uncertain if they are SWWF or Northern Flycatchers.

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SUMMARY OF EFFECTS FOR LISTED SPECIES

SPECIES	ALT 1	ALT 2
Bald Eagle	No Effect	No Effect
Peregrine Falcon	No Effect	No Effect
Southwestern Willow flycatcher	No Effect	No Effect

Socio-Economics:

Alternative 1

Under the "No Action" alternative, the Forest Service would not consent to the amendment of the R2P2 and the subsequent mine plan modification and the subsequent permits would not be amended as proposed by the responsible agencies. Mining of the permitted area would be done in September of 2003, resulting in 263 miners potentially losing their jobs at that point in time.

Alternative 2

Under the action alternative, the Forest Service would consent to the amendment of the R2P2 and the subsequent mine plan modification. Longwall mining would be permitted in both seams for the 2 southern panels extending mine life to September of 2005. The Deer Creek Mine currently employs 263 miners who would potentially keep their jobs longer as the North Rilda area is mined out if the action alternative is selected. Additionally, the royalties returned to the US Treasury would be increased if the action alternative is selected as shown in Chapter 2 "Comparison Summary Of Alternatives".

C. CUMULATIVE IMPACTS

The cumulative impacts of past and present activities in combinations with each alternative are presented in the preceding section by issue topics

Alternative 1

Historically man's activities in the project area have included livestock grazing, recreational use, and coal production, which have resulted in changes in the topography, vegetation, and erosion. Cumulative effects resulting from mining coal could include the effects from subsidence and the human activity from continued operations as it exists on these leases and adjacent leases. PacifiCorp is monitoring the impacts of mining on the permit area as part of the Mining and Reclamation Plan. To date, the results of monitoring in the permit area indicate that no notable impacts to surface resources have occurred from mining. (Deer Creek Mine submits subsidence and hydrologic monitoring reports annually as a requirement of their MRP.) There would be no change in the existing condition.

Past and present fossil fuel exploration drilling and production within the surrounding area has and will remove minimal amounts of water and disturb relatively small to medium amounts of surface areas and

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vegetation habitat. In the past, impacts to sensitive species have been insignificant. In the reasonable foreseeable future, it is estimated that additional drill exploring and production of gas/coal is likely.

Other forest-use practices and natural events have affected wildlife habitat within the project area. Livestock grazing is one of the primary forest uses in the area. Livestock use has decreased foraging opportunities through competition and have altered vegetation of the habitat, although the previous work in Rilda Canyon has lead to mitigation, including the exclusion of livestock above the cattleguard at the North Emery Water Users Association spring development. Additionally, Rilda Creek was probably perennial below the forks prior to the NEWUA spring development.

Activity from hauling and recreational use in Rilda Canyon has increased in part due to the road improvements done on 1994 providing better access. The road construction (improvements) however have probably lead to an overall decrease in sedimentation to the creek.

Noise in the canyon has been increased due to the increased human presence, traffic on the road, and the construction of the portals and fans at Deer Creek Mine's Rilda Canyon Breakout facility located in the south fork.

Visual Quality in the canyon has been altered by the installation of the powerline to support the Rilda Canyon Breakout facility, as well as the facility itself.

Alternative 2

The cumulative impacts presented for Alternative 1 would persist with implementation of this alternative. Cumulative impacts from other resource activities (i.e. timber, grazing) are similar to those for Alternative 1.

Past and present fossil fuel exploration drilling and production within the surrounding area has and will remove minimal amounts of water and disturb relatively small to medium amounts of surface areas and vegetation habitat. In the past, impacts to sensitive species have been insignificant. In the reasonable foreseeable future, it is estimated that additional drill exploring and production of gas/coal is likely. Potential threats to wildlife foraging and nesting areas could exist, and continual mineral activity could decrease habitat. The mining company conducted a study to determine the likelihood of escarpment failure, the result of the study indicate that 69% of the escarpment is in the high potential for failure category. The longwall mining beneath the escarpment has the potential to remove a portion of the vertical rock face. Escarpments in this area are naturally falling however the mining would cause this process to be accelerated. Over time the escarpment should continue to erode and new ledges created. The failure of the escarpment would remove some cliff face and impact pinyon-juniper habitat. There would be no cumulative effects to any of the other Threatened or Endangered species. As a mitigation measure raptor activity should continue to be monitored to determine if any select the Rilda Canyon area as a nesting site. If bald or golden eagles, or peregrine falcons select the canyon as a nesting location then consultation with the US Fish and Wildlife Service and the Utah Division of Wildlife Resources will be initiated prior to proceeding with mining that would cause loss of the new nest(s).

Similar to the effects in Alternative 1, except that the magnitude of impacts could be increased. There will be an increase in erosion of the Castlegate Sandstone escarpment, primarily accelerated by the stresses placed on the rock by subsidence and associated rockfalls.

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CHAPTER 5
Personnel and Public Involvement

A. INTERDISCIPLINARY TEAM

Specialty	Resource Specialist	Role
NEPA/Geology	Jeffrey Wade DeFreest	Team Leader
Wildlife	Stan Anderson	Core Team
BLM/Economics	George Tetreault	Core Team
OSM	Floyd MacMullen	Extended IDT
Cultural Resources	Stan MacDonald	Extended IDT
Botany	Bob Thompson	Extended IDT
Landscape Architect	Kevin Draper	Extended IDT
NEPA	Reta Laford	NEPA Coordinator

B. PUBLIC INVOLVEMENT

Internal scoping for this project included review by various Forest Service resource specialists.

External scoping consisted of notice in the Forest's *Schedule of Proposed Actions*, Legal Notice published in the Sun Advocate (May 5th 1998), a News Release to the Sun Advocate from which an article was written about the project (May 5th, 1998), and by letter to a 18-person mailing list. Those individuals to whom letters were mailed included: Federal, State, and local governmental or land management entities; adjacent landowners and mining companies; range permittees; and others known to be potentially interested or affected. Three letters were received in response to external scoping. The entirety of these letters can be found in the project record.

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CHAPTER 6
References

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Utah Division of Wildlife Resources. 1980. Bats of Utah. UDWR Publication No.80-15.

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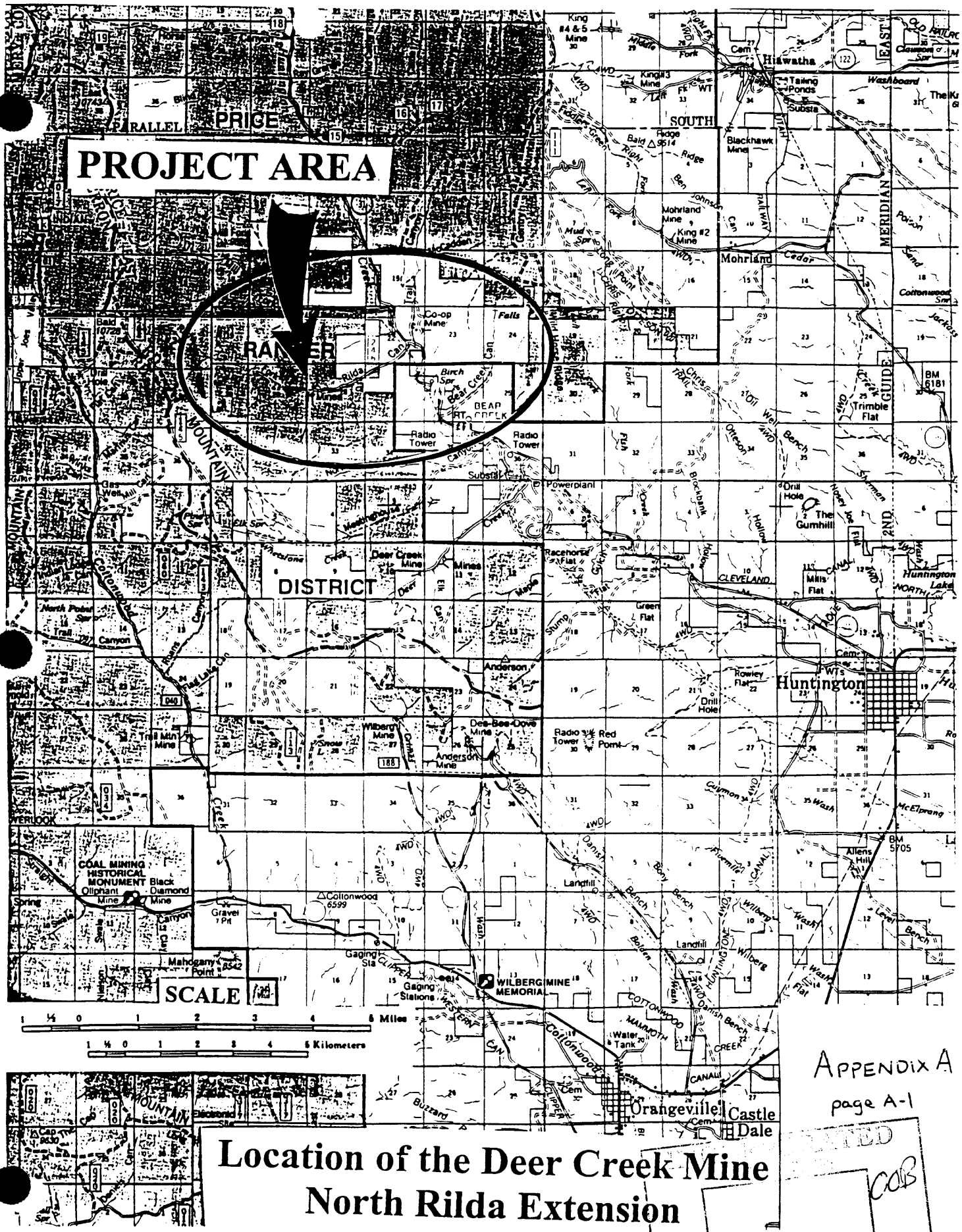

Location of the Deer Creek Mine North Rilda Extension

APPENDIX A
page A-1

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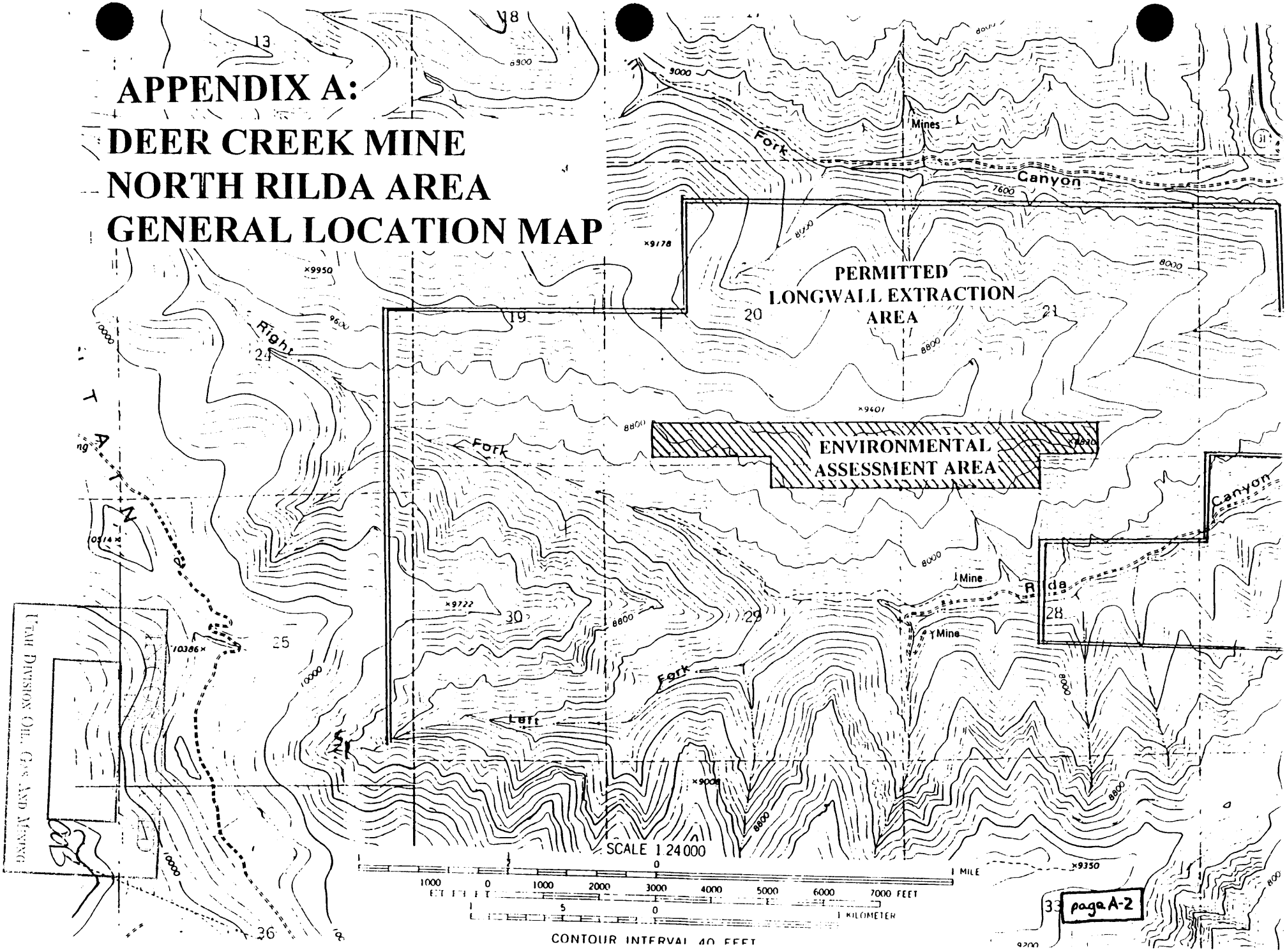
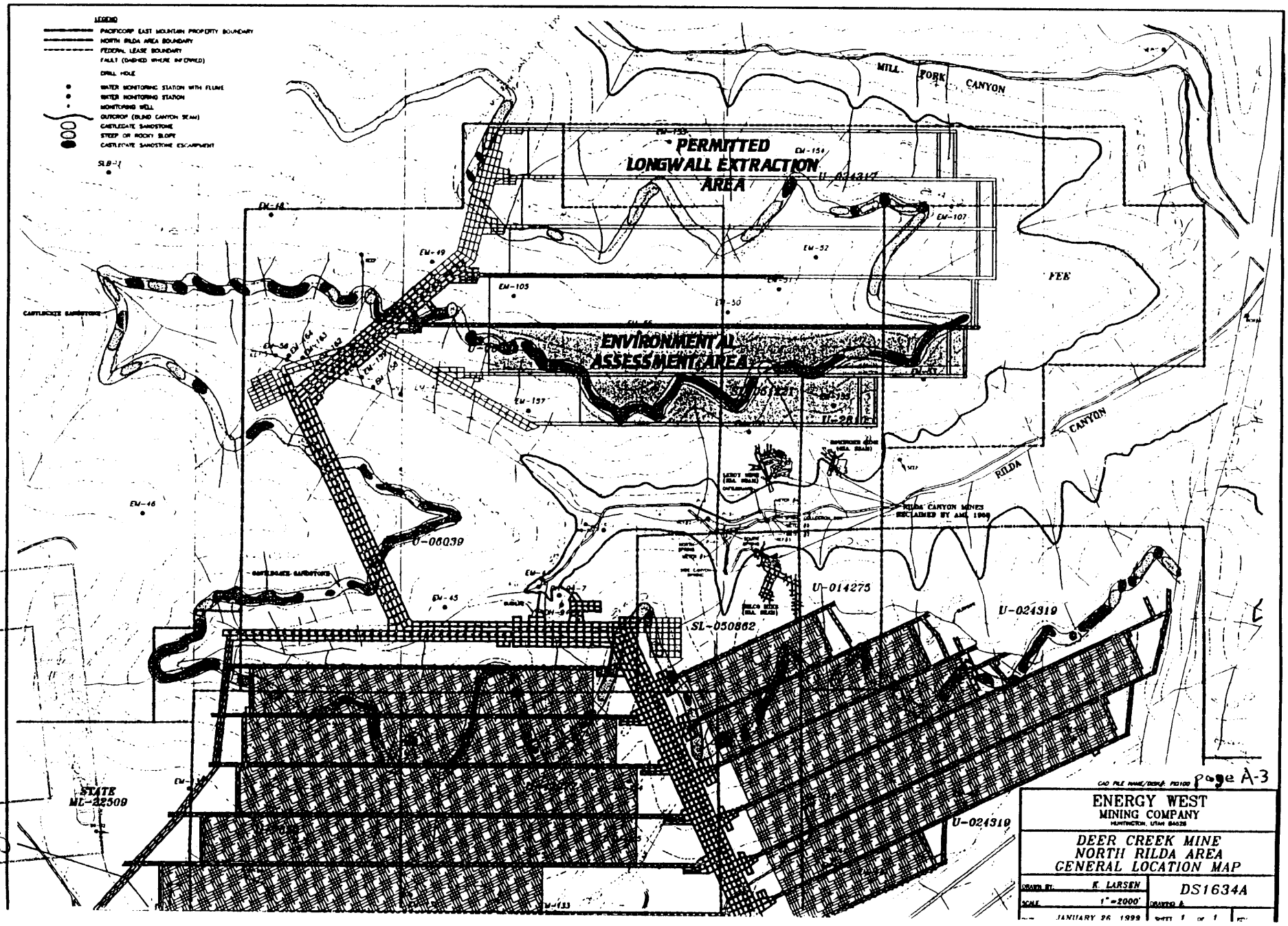
APPENDIX A:
DEER CREEK MINE
NORTH RILDA AREA
GENERAL LOCATION MAP





UTAH DIVISION OIL, GAS AND MINING

R645-301-500 ENGINEERING SECTION

APPENDIX D

♦DECISION NOTICE AND FINDING OF NO SIGNIFICANT IMPACT

Deer Creek Mine
North Rilda Extension

Decision Notice And Finding Of No Significant Impact

(Township 16 South, Range 7 East, Sections 20, 21, 28, and 29, Salt Lake Meridian)

USDA Forest Service, Intermountain Region
Manti-La Sal National Forest
Ferron/Price Ranger District
Emery County, Utah

I. INTRODUCTION

The Manti-La Sal National Forest and Bureau of Land Management (BLM) Price Field Office have prepared an environmental assessment (EA) for a proposal submitted by Energy West Mining Company, Deer Creek Mine. The proposed action is for the cooperating agencies to allow Deer Creek Mine to conduct full extraction longwall mining and subside the escarpments on the north slope of Rilda Canyon by amending their mining and reclamation plan for the North Rilda Canyon vicinity. The Office of Surface Mining also participated as a cooperating agency. The area of the proposal lies on National Forest System lands administered by the Manti-La Sal National Forest, Ferron-Price Ranger District, Emery County, Utah in Township 16 South, Range 7 East, Sections 20, 21, 28, and 29, Salt Lake Meridian.

The preferred alternative for implementation is Alternative 2 (Proposed Action). Alternative 2 is detailed in the EA on page II-1. Alternative 2 would permit Deer Creek Mine to conduct full extraction, longwall mining beneath the Castlegate Escarpment on the north slope of Rilda Canyon, which would lead to surface subsidence and probable rockfalls.

To implement Alternative 2: the Forest Service would consent to, and the BLM would approve, a change to the Resource Recovery and Protection Plan (R2P2), and the Forest Service would consent to, and the Utah Division of Oil, Gas and Mining would approve the amendment to Deer Creek Mine's mining and reclamation plan.

II. DECISION

I have decided to implement Alternative 2 as described in the Environmental Assessment (EA, pp.II-1) and summarized in this document.

I consent to the modification of the R2P2 by the BLM, and consent to approval of the amendment of the Mining and Reclamation Plan by DOGM which would allow Energy West's Deer Creek Mine to conduct full extraction longwall mining and subside the escarpments in the north slope of Rilda Canyon as shown in Appendix A. Conditions of my consent are as follows:

1. Energy West will post warning signs at specified points in Rilda Canyon, warning recreational users of the potential rockfall hazards, as stated in their proposal.

2. All commitments in the mining and reclamation plan will be adhered to.

3. Energy West will also monitor subsidence through their mine plan requirements and provide higher resolution monitoring data for the north slope of Rilda Canyon by providing a complete photographic

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record, including before and after photograph sets of the escarpment area; and by installing prisms for accurate surveying on the top of the escarpments to determine when subsidence is substantially complete.

My decision will be implemented through the issuance of this Decision Notice. Forest Service regulations require the permittee to secure any additional state or federal permits or authorizations required by law.

III. RATIONALE FOR THE DECISION

This decision was made after careful consideration of the contents of the Environmental Assessment, public involvement, and the entirety of the supporting record. No one fact or single piece of information led to my decision. Rather, a combination of factors contributed to it. I have summarized some of my key considerations in the following sub-parts.

Relationship to the Purpose and Need:

The general purpose and need for this project is to accomplish the following goal of the Forest Plan: "Provide appropriate opportunities for and manage activities related to locating, leasing, development, and production of mineral and energy resources" (Forest Plan, p. III-4).

The project-specific purpose and need of the proposed action is to maximize coal recovery and extend the mine life. This purpose and need also allows the BLM to achieve maximum economic recovery of coal from the Federal Coal Lease.

My decision wholly meets the project's purpose and need (EA, p. I- 2). Meeting this purpose and need also allows the BLM to meet their responsibility to guarantee that all recoverable coal reserves are identified to achieve maximum economic recovery (MER) of coal.

Relationship to Other Alternatives Considered:

I have also reviewed the other alternative analyzed in the Environmental Assessment (EA, pp. II-1).

Alternative 1 (no action) would not meet Forest Plan direction to "Provide appropriate opportunities for and manage activities related to locating, leasing, development, and production of mineral and energy resources." (Forest Plan, p. III-4), nor would it allow the BLM to meet their responsibility of MER.

Relationship to Existing and Potential Resource Conditions:

I have considered existing resource conditions and potential environmental effects in making this decision (EA, Chapter 3 & 4; Project Record). The design of Alternative 2 and included stipulations will adequately provide for the proposed activity consistent with Forest Service land management direction, and applicable laws and regulations.

Relationship to Public Involvement:

Public comments were sought and considered throughout the planning process for this project (refer to Section V of this document for a summary of public involvement). I have reviewed and considered the issues and concerns identified during the scoping process. My decision considers all public comments received.

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Relationship to Laws and Regulations:

My decision is consistent with applicable laws, regulations, and policies (refer to Section VII of this document).

IV. SUMMARY OF ALTERNATIVES CONSIDERED

Two alternatives were considered as part of this project; Environmental Assessment (EA, pp. II-1 - II-2). A summary of the alternatives considered in detail follows.

Alternative 1 - No Action

Forest Service would not consent to the proposed action and mining would continue under the approved R2P2 and MRP. Subsequently, the BLM would not approve the proposed amendment to the R2P2 and DOGM would not approve the corresponding mine permit amendment. Alternative 1 addresses the need to provide a "No Action" alternative (40 CFR 1502.14) and provides a benchmark for evaluating the effects of implementing the proposal. The operator would not be permitted to conduct full extraction longwall mining under the escarpment.

Though full support mining is already permitted under the current mining plan, the reserves would not be economical to mine (personal communication with Chuck Semborski, Energy West Mining Co., June 1999, and George Tetreault, BLM, July 1999). No mitigation measures or monitoring would be required as part of this alternative, beyond what is already in the mining and reclamation plan.

Alternative 2 - Consent to Mining as Proposed

This alternative wholly responds to the purpose and need.

The Forest Service would consent to the modification of the R2P2 by the BLM, and consent to approval of the amendment of the Mining and Reclamation Plan by DOGM which would allow Deer Creek Mine to conduct full extraction longwall mining and subside the escarpments in the north slope of Rilda Canyon as shown in Appendix A.

Additionally, Energy West would post warning signs at specified points in Rilda Canyon, warning recreational users of the potential rockfall hazards, as stated in their proposal. All commitments in the mining and reclamation plan would be adhered to.

The Energy West would also monitor subsidence through their mine plan requirements and as proposed, provide higher resolution monitoring data for the north slope of Rilda Canyon by installing prisms for accurate surveying on the top of the escarpments to determine when subsidence is substantially complete.

These commitments are made in the project proposal and are further identified in the EA (p. II-1).

V. PUBLIC INVOLVEMENT

Internal scoping for this project included review by various Forest Service resource specialists such as the geologist, hydrogeologist, botanist, wildlife biologist, range conservationists, recreation specialist, and landscape architect.

External scoping consisted of notice in the Forest's *Schedule of Proposed Actions*, Legal Notice published in the Sun Advocate (May 5th 1998), a News Release to the Sun Advocate from which an

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article was written about the project (May 5th, 1998), and by letter to a 18-person mailing list. Those individuals to whom letters were mailed included: Federal, State, and local governmental or land management entities; adjacent landowners and mining companies; range permittees; and others known to be potentially interested or affected. Three letters were received in response to external scoping. The entirety of these letters can be found in the project record.

The completed EA was released for public comment on July 19th, 1999, and two responses were received, both of which are included in the project file, and are addressed in the EA's "Response to Comments" (EA, Appendix B) included with this Decision Notice. The first response was from Clint Sherman, in the form of a telephone call which was documented by Aaron Howe, Forest Engineer, and the second comment was a letter received from the attorney for Huntington-Cleveland Irrigation Co. These comments and the responses were considered in conjunction with the EA in making this decision.

VI. FINDING OF NO SIGNIFICANT IMPACT

Based on my review of the EA and supporting record, I have determined that this decision does not constitute a major Federal action significantly affecting the quality of the human environment, as defined in the Code of Federal Regulations title 40 part 1508, section 27 (40 CFR 1508.27) in either context or intensity. Therefore, it is my decision that an Environmental Impact Statement is not necessary, and will not be prepared. My rationale for this determination is summarized below.

Context

Locality. Implications of this decision are primarily for the Rilda Canyon area. The effects on public land use and users would remain consistent with that which is currently occurring. (EA, Project Record)

Affected Interests. Affected interests for this project are primarily recreation enthusiasts, State resource management agencies, and other entities with interests in wildlife and water management. (EA, Project Record)

Affected Region. The decision is a site-specific action with impacts primarily to the local area. The context of this decision is comparable to many projects on the Manti-La Sal National Forest and would not measurably affect the region.

Society. No effects are anticipated to society as a whole, though local communities are expected to benefit from the extended life of the mine and associated employment opportunities.

Intensity

1. Consideration Of Beneficial And Adverse Impacts. Consideration of beneficial and adverse impacts has been made in the EA (Chapter 4). Impacts of this decision will be similar to that of past projects involving undermining of escarpment. Although both beneficial and adverse effects are disclosed, none are of enough magnitude to be considered significant.

2. Consideration Of Public Health And Safety. Public health or safety issues concerning this decision were considered through the analysis. The Colorado Rockfall Simulation Program was applied and risks of dislodged rocks reaching the road were established to be very low. Additionally, mitigation in the form of signing has been made a part of the decision to ensure public health and safety (EA, II-1).

3. Consideration Of Unique Characteristics Such As Proximity To Historic Or Cultural Resources, Park Lands, Prime Farmlands, Wetlands, Wild And Scenic Rivers, Or Ecologically Critical Areas. Historic and cultural resources are addressed in the following Item 8. There are no prime farmlands, rangeland, or forest

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land as defined in the Secretary of Agriculture's Memorandum Number 1827, Supplement 1, identified on the Forest (Forest Plan, p. II-57). Wetlands would not be affected as this decision requires avoidance of the wetlands as described in the EA. There are no parklands or wild and scenic rivers identified in the Forest Plan. The area of my decision has not been identified by any source as an ecologically critical area (Project File - Biological Assessment and Evaluation).

4. Consideration Of The Degree To Which The Effects On The Quality Of The Human Environment Are Likely To Be Highly Controversial. This decision is not unique, several other projects involving escarpment undermining have been approved over the last 10 years (Trail Mountain Mine, SUFCo Mine). Effects on the quality of the human environment are understood and are not highly controversial. Scoping on the proposed action and solicitation of comments on the Environmental Assessment and pre-decision demonstrated that there is not much public controversy over potential effects. No information or data has been presented to demonstrate that the effects are highly controversial.

5. Consideration Of The Degree To Which The Possible Effects On The Human Environment Are Highly Uncertain Or Involve Unique Or Unknown Risks. This decision is not unique, several other projects involving escarpment undermining have been approved over the last 10 years (Trail Mountain Mine, SUFCo Mine). The Manti-LaSal National Forest has experience in implementing and monitoring similar projects, the effects of which have been found to be reasonably predictable. No effects from this decision would be classified as highly uncertain or involving unique or unknown risks.

6. Consideration Of The Degree To Which The Action May Establish A Precedent For Future Actions With Significant Effects Or Represents A Decision In Principle About A Future Consideration. This decision is not precedent setting.The Manti-LaSal National Forest generally considers and analyzes the permitting of several mine plan amendments or modifications each year. Any future proposals would have to be evaluated on their own merits based on the issues and effects related to the location, timing and intensity of each action.

7. Consideration Of The Action In Relation To Other Actions With Individually Insignificant But Cumulatively Significant Impacts. No reasonably foreseeable future projects have been identified that would in connection with this decision produce cumulative effects beyond those currently occurring. The limited scale of activity creates minimal individual effects, as well as minimal cumulative effects when added to the existing situation and other potential activities.

8. Consideration Of The Degree To Which The Action May Adversely Affect Areas Or Objects Listed In Or Eligible For Listing In The National Register Of Historic Places Or May Cause Loss Or Destruction Of Significant Scientific, Cultural, Or Historical Resources. Record and field reviews indicate that no cultural or historic sites would be affected by this decision (EA, p.III-11 and Project Record).

9. Consideration Of The Degree To Which The Action May Adversely Affect An Endangered Or Threatened Species Or Its Habitat Has Been Determined Not To Be Critical Under The Endangered Species Act. The US Fish and Wildlife Service has been included in the process. A Biological Assessment has been conducted for this decision (Project Record -Biological Assessment and Evaluation). All known endangered or threatened species were considered. The Biological Evaluation concludes that this decision will have "no effect" to listed or proposed species (EA, p. IV-9).

10. Consideration Of Whether The Action Threatens A Violation Of Law Or Requirement Imposed For The Protection Of The Environment. To the best of my knowledge, this decision does not threaten violation of any laws and regulations imposed for the protection of the environment (refer to Section VII of this document).

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VII. FINDINGS REQUIRED BY OTHER LAWS AND REGULATIONS

To the best of my knowledge, this decision complies with all applicable laws and regulations. In the following, I have summarized the association of my decision to some pertinent legal requirements.

Federal Land Policy and Management Act of 1976: This Act allows the granting of land use permits on National Forest System lands. The regulations at Code of Federal Regulations Title 36 part 251 (36 CFR 251) guide the issuance of permits under this Act. Land use permits are granted on National Forest System lands when the need for such is consistent with planned uses.

National Forest Management Act of 1976: The Forest Plan was approved November 5, 1986, as required by this Act. This long-range land and resource management plan provides guidance for all resource management activities in the Forest. The National Forest Management Act requires all projects and activities to be consistent with the Forest Plan. The Forest Plan has been reviewed in consideration of this project. This decision will be consistent with the Forest Plan.

Potential effects to wildlife resources are also evaluated (EA pp. IV-4 - IV-6), including identified sensitive species, in compliance with the Act direction. "No Impact" or "May Impact Individuals or Habitat, But Not Likely to Contribute to a Trend Towards Federal Listing or Loss of Viability to the Population or Species" determinations were reached for all species analyzed.

Coal Leasing Amendments Act of 1975: Forest Service consent to the conditions of approval is required under this act. This decision document constitutes my consent on behalf of the agency.

Mineral Leasing Act of 1920: The Bureau of Land Management (BLM) is the responsible agency for permitting, under the Mineral Leasing Act of 1920, as amended. The Forest Service, as the surface management agency, must consent to the BLM decisions pertaining to leasing actions or exploration activities. This decision document constitutes my consent on behalf of the agency.

Surface Mining Control and Reclamation Act of 1977(SMCRA): This act gives the Department of the Interior, Office of Surface Mining (OSM), primary responsibility to administer programs that regulate surface coal mining operations and the surface effects of underground coal mining operations. Pursuant to sections 503 and 523 of SMCRA, under the oversight of the OSM, the Utah Division of Oil, Gas and Mining regulates surface coal mining and the surface effects of underground coal mining on Federal and non-Federal lands within the State of Utah. On National Forest lands, consent must be obtained from the Forest Service, as the surface management agency, prior to approval of mining activities, including exploration drilling. This decision document constitutes my consent on behalf of the agency.

National Historic Preservation Act: Compliance with this Act and the American Indian Religious Freedom Act are addressed in Section VI of this document.

Endangered Species Act: Compliance with this Act is addressed in Section VI of this document.

National Environmental Policy Act: The entirety of documentation for this project supports that the project complies with this Act.

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VIII. IMPLEMENTATION DATE AND APPEAL OPPORTUNITY

This Forest Service decision is subject to appeal under 36 CFR 215. Permit holders or permit applicants responding to Forest Service issued prospectus who may be affected by this decision have the choice to appeal under 36 CFR 215 or 36 CFR 251.

The Forest Service decision is subject to administrative review by the Regional Forester pursuant to the above cited regulations. Any written appeal must be postmarked or received by the Appeal Deciding Officer within 45 days from the day after publication of the legal notice in the Price *Sun Advocate* newspaper. Appeals should be sent to Regional Forester-Intermountain Region, 324 25th Street, Ogden Utah 84401 on or before December 17th, 1999. Appeals must meet the content requirements of 36 CFR 215.14.

IX. CONTACT PERSON

For additional information concerning this decision, please contact Jeff DeFreest at the Ferron/Price Ranger District (address: 599 West Price River Drive, Price, UT 84501; telephone: 435-637-2817).

X. SIGNATURE AND DATE

JANETTE S. KAISER
Forest Supervisor (Responsible Official)
Manti-La Sal National Forest

Date 11-1-99

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October 1999

RESPONSE TO COMMENTS
Deer Creek Mine
North Rilda Extension
Environmental Assessment
APPENDIX B

Introduction:

The Environmental Assessment was released for public comment on July 19, 1999. There were two parties that responded with formal comments.

The first of which was in the form of a telephone call from Mr. Clint Sherman of Cleveland Utah and documented by Aaron Howe, Forest Engineer.

The second comment received was in the form of a letter from the law firm of Nielsen and Senior on the behalf of Huntington-Cleveland Irrigation Company.

Comments and Response to Comments:

A. Phone Call with Clint Sherman:

Comment:

Mr. Sherman apparently uses the mid to upper portion of this area (adjacent to escarpment) in the spring time and is concerned that falling rock could land on him as he collects antlers or that rocks may land or roll into the road.

Response:

Warning signs are to be installed by the Energy West at extents of the project area advising recreational users of the potential for rockfalls near the escarpment.

The rockfalls are not expected to reach the road. The Colorado Rockfall Simulation Program was applied to the proposed subsidence area (project file) and the analysis does not show any rocks reaching the road. If rocks would reach the road, the mine would attend to removing them.

Comment:

Mr. Sherman is concerned about the potential for the falling rock to displace the elk that winter adjacent to the escarpment.

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Response:

The escarpment would not all fail at once because the mining progresses rather slowly and the elk should not move out of the area due to periodic rock falls.

Comment:

Mr. Sherman was concerned about the potential for the Rilda (canyon) road to be closed (administratively) during the subsidence period.

Response:

Administrative closure of the road was not part of the proposal or required mitigations. It should also be noted that the Rilda Canyon Road is a county road and that Emery County would have to make a decision to restrict use up the canyon.

B. Nielsen & Senior Letter:

Comment:

"The EA at page I-3 recognizes water resources may be impacted, but then attempts to down play the importance of a single known seep within the project area."

Response:

The EA identifies one seep near the eastern end of the project area. The EA describes this feature on page I-3 and indicates that the "seep (no live surface water) near the eastern end of the project area on the ridge between Rilda and Mill Fork Canyons" is "too small to be developed for a water source." It is further discussed in the EA on page IV-4, "The seep on the ridge could be altered as a result of mining and subsidence leading to corresponding vegetation changes.". Subsidence/alteration of this seep is expected to result in the seep location migrating down-dip but no diminishment of flow is anticipated.

Comment:

"It is also unclear whether the project area and adjacent areas were carefully surveyed for additional seeps and springs."

Response:

The area has been carefully surveyed for seeps and springs. PacifiCorp initially conducted the East Mountain Spring and Seep Surveys during the 1979 and 1980 field seasons. Additionally, in cooperation with the NEWUA and Huntington Cleveland Irrigation Company, PacifiCorp conducted a comprehensive hydrologic investigation of the Rilda Canyon Springs during 1989. Further analysis was conducted by PacifiCorp as part of their Mining and Reclamation Plan for the North Rilda Permit area (Deer Creek MRP, Vol. 11, approved July 1997).

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Comment:

"Additionally, the relationship between groundwater in the project area and the springs utilized by NEWUA is not adequately addressed."

Response:

The relationship is identified on page III-2 of the EA. "The springs are fed by the alluvial system in Rilda Creek and the majority of their recharge is from springs at the head of Rilda Canyon, west of the project area. A north-south fracture system is also thought to partially feed the NEWUA springs." Potential impacts to the springs are identified in Chapter 4 under each alternative considered.

Alternative 1 (No Action)

"The north-south fracture system thought to be partially feeding the NEWUA springs could be altered by full support mining authorized by the current MRP and R2P2."

Alternative 2 (Preferred)

"Any unforeseen damage to permitted facilities on National Forest System lands would be required to be repaired under the existing lease stipulations. Likewise, water loss (quality or quantity) would require replacement, and damages done to stream and riparian environments would also be repaired by the mine under their existing mining and reclamation plan."

"The north-south fracture system thought to be partially feeding the NEWUA springs could be altered by full support mining authorized by the current MRP and R2P2 or by the action alternative allowing longwall mining and subsequent subsidence."

"The seep on the ridge could be altered as a result of mining and subsidence leading to corresponding vegetation changes."

Recent information from Chuck Semborski (project file) pertaining to the presence of the north-south fracture system indicates that "mining has not encountered any structural anomalies along the proposed north-south trend and interception of ground water has been minimal". This information is based on their development mining of the length of Rilda Ridge in the already permitted 4 panels north of the project area considered in this EA and decision. There is no reason to believe that the fracture system would be encountered mining the two panels to the south included in this project area.

Comment:

"While the EA acknowledges the Springs in Rilda Canyon that provide drinking water for those served by North Emery Water Users Association ("NEWUA"), it fails to recognize the holder of the water rights under which NEWUA receives its water."

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Response:

NEWUA is the Special Use Permit holder for the subject springs in Rilda Canyon for the authorized purpose of providing culinary water. The specific ownership of the water is not germane to this analysis, though it is recognized that Huntington-Cleveland Irrigation Company does hold the water rights and NEWUA receives their water from Huntington-Cleveland Irrigation Company. Potential impacts to the water resources are considered regardless of who the specifically owns the water rights.

Comment:

"Tellingly, there is not a single hydrologist on the interdisciplinary team."

Response:

Liane Mattson (former Hydrogeologist on the Manti-LaSal NF) was involved with the review of the submittal (proposal) from Deer Creek Mine, has been involved with numerous hydrological studies in the vicinity, and participated in the preparation and review of this Environmental Assessment as an extended IDT member. Her name was inadvertently left off of the EA.

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R645-301-500 ENGINEERING SECTION

APPENDIX E

♦DOGM LETTER - CONSENT TO CONDUCT MINING

State of Utah
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF OIL, GAS AND MINING

Michael O. Leavitt
Governor

Kathleen Clarke
Executive Director

Lowell P. Braxton
Division Director

1594 West North Temple, Suite 1210
PO Box 145801
Salt Lake City, Utah 84114-5801
801-538-5340
801-359-3940 (Fax)
801-538-7223 (TDD)

November 10, 1999

Chuck Semborski, Environmental Supervisor
Energy West
P. O. Box 310
Huntington, Utah 84528

Re: Conditions Revisited for Deer Creek Mine Permit, PacifiCorp, Deer Creek Mine, ACT/015/018, Folder #3, Emery County, Utah

Dear Mr. Semborski:

The recent Decision Notice and Finding of No Significant Impact document (copy attached) issued by the Manti-La Sal National Forest has prompted us to revisit the Deer Creek Mine Permit and the attached conditions. Condition Number 3 is as follows:

> *Mining in the "North Rilda Lease" area is authorized to the extent that the Surface Managing agency (U. S. Forest Service) has provided consent, per letters dated July 3, 1997 and July 15, 1997 (attached.)*

We recognize that the Forest Service document adds another level of consent to the already issued permit. This letter authorized PacifiCorp to conduct mining in the North Rilda Lease area in accordance with the consent granted in the Forest Service Decision Notice. This includes the conditions identified in the Decision Document. Of course this authorization becomes effective only after the Decision Document has gone through the appeals period and is finalized.

Please keep us apprised of any changes to your mine plan as a result of this action. If you have any questions, please call me.

Sincerely,

Daron R. Haddock
Permit Supervisor

tm
Enclosure
cc: Janette Kaiser, USFS
Richard Manus, BLM
Price Field Office
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INCORPORATED
EFFECTIVE:
UTAH DIVISION OIL, GAS AND MINING

R645-301-500 ENGINEERING SECTION

APPENDIX F

♦NORTH RILDA CANYON FACILITIES GEOTECHNICAL INVESTIGATION

RILDA CANYON

Geotechnical
Investigations
1991

RB&G ENGINEERING INC.
1435 WEST 820 NORTH
PROVO, UT 84601-1343
801 374-5771 Provo
801 521-5771 SLC

Rilda Canyon Mine Facilities

Emery County, Utah

Geotechnical Investigation for Preliminary Design

9101-166

GEOTECHNICAL INVESTIGATION
FOR PRELIMINARY DESIGN

Rilda Canyon Mine Facilities

Emery County, Utah

1991

RB&G ENGINEERING, INC.

Professional Engineers

November 27, 1991

RB&G ENGINEERING INC.

1435 WEST 820 NORTH
PROVO, UT 84601-1343
801 374-5771 Provo
801 521-5771 SLC

Roberts & Schaffer
5225 Wiley Post Way
Salt Lake City, UT 84116

Gentlemen:

A geotechnical investigation has been completed at the general site of the proposed Rilda Canyon Mine Facilities to be located in Rilda Canyon, which is west of Huntington Canyon approximately 11 miles northwest of Huntington, in Emery County, Utah. The Rilda Canyon facilities will provide new mine support for the Deer Creek Mine. The investigation was performed (1) to define the characteristics of the subsurface material where the new facilities will be located so that satisfactory substructures can be designed to support these facilities, and (2) to make recommendations relating to cut and fill slopes, soil strength parameters and construction requirements. The investigation has generally been completed in accordance with a written proposal submitted to your organization for the work. Permitting restraints prohibited access to test boring sites for a number of the facilities. These facilities included the 100,000 gallon water tank, the pump house and the mine portal approaches. Since it was not possible to obtain access for drilling purposes, it was determined to run seismic refraction lines to obtain a preliminary estimate of the depth of overburden at the non-accessible drill locations. It is contemplated that test borings will be drilled at these locations during final design once access permits are obtained. The results of the investigation, along with pertinent recommendations, are outlined in the following sections of this report.

The information contained in the report is discussed under the following headings: (1) Geological and Existing Site Conditions (2) Subsurface Investigation, (3) Seismic Refraction Investigation, (4) Field and Laboratory Tests, and (5) Design Considerations and Recommendations.

1. GEOLOGICAL AND EXISTING SITE CONDITIONS

Figure 1 is a photo copy of portions of the USGS Quadrangle maps for this general area. It will be observed from this figure that Rilda Canyon is located on the west side of Huntington Creek west of Highway 31. The primary mine facilities will be located up the left

fork of Rilda Canyon as shown in Figure 1. A new road alignment will extend from Highway 31 to the Left Fork of Rilda Canyon which will require a new bridge to be constructed across Huntington Creek. A sediment pond and a leach field area are also contemplated between the Left Fork and Huntington Creek at approximate locations as shown in Figure 1. A detailed geologic map of the area where facilities will be located in the Left Fork of Rilda Canyon is presented in Figure 2. The general geology for this area is described below as follows:

> The area is located along the eastern slope of the Wasatch Plateau in Central Utah. The dominant sediments in the region include Cretaceous clastics deposited as part of a marine depositional system and Tertiary lacustrine sediments which overlie the Cretaceous rocks. The Cretaceous sediments were deposited in an environment dominated by an epicontinental sea which existed at that time. More locally, these sediments consist largely of sands and silts deposited in beach and near shore, barrier bar environments. Large lagoons with lagoonal swamps formed in association with the barrier bars and were the sites of deposition for large quantities of organic materials which were eventually transformed into coal. This series of shore and off shore sediments are found within the Mesaverde group which includes the Blackhawk formation and the Starpoint sandstone.
>
> Structurally, the area lies within the transition zone between the Basin and Range and the Colorado Plateau physiographic provinces. The Colorado Plateau is relatively quiet in terms of seismicity, while the Basin and Range is the site of active crustal extension and associated faulting. The tectonics of the transition zone are not well understood and is the subject of debate among researchers. Several faults have been mapped in the area, but the immediate area within the Left Fork of Rilda Canyon appears to be free of structures bearing significant offset.
>
> The Cretaceous sediments found within the Left Fork of Rilda Canyon consist chiefly of barrier-bar sands with intercalated silt and mud which were deposited in deeper water. Also present are at least two coal seams, the Blind Canyon seam and the Hiawatha seam. These coal seams are the target of exploration and development in the area.

The geology of Rilda Canyon is described below as follows:

> Rilda Canyon is a tributary drainage of Huntington Creek and runs slightly north of East. The Left Fork of Rilda Canyon splits off to the southwest about three miles up canyon from its confluence with Huntington Creek. The south side of the canyon within the Left Fork is covered by a dense forest of large pine trees and aspen with a thick understory growth of willow, wild rose, juvenile pines and

other shrubs. A layer of forest litter covers the ground and, in places, is up to two feet thick. The north side of the canyon is only sparsely populated by large trees. Here the plant population is dominated by pinion and juniper trees with abundant sage, cactus and other desert shrubs.

The north side of the Left Fork exposes several outcrops of Cretaceous sedimentary rocks. These consist of prominent cliff-forming, vertically jointed barrier bar sandstone deposits up to thirty feet tall in places, with splay deposited sandstone found above and, in places, below the barrier bars. These sandstones are intercalated with mudstones and siltstones deposited in back-bar lagoonal settings. The finer grained sediments are generally blanketed by a thin colluvial cover on the slopes of the canyon wall, but they do outcrop in patches and are exposed in the old drill road cut. Colluvial evidence of the coal seams can also be found along the slopes of the north side of the canyon. The colluvium consists of sandy gravel with abundant sandstone boulders and many large sandstone blocks up to about 20 feet across. The blanket of colluvium which covers this side of the canyon is typically thin along most of the slopes, but thickens considerably towards the bottom of the canyon where it grades into finer grained alluvium. RB&G Drill Hole 10 went to a depth of 50 feet below the canyon floor without encountering bedrock. Seismic data also indicates a relatively thick alluvial floor elsewhere in the canyon. The alluvial floor of the canyon probably thickens downstream.

At about PC 3+03.15 along the UP&L surveyed baseline on the north side of the canyon, a debris cone exists, channeled between two horizontally separated sandstone cliffs (reference Figure 2.) It is unclear if the debris was simply channeled by two distinct barrier bar deposits, or whether transport occurred in response to failure along jointing within a single continuous barrier bar.

The south side of the canyon is almost completely covered by a thick cover of forest. Prominently jointed sandstone cliffs up to twenty feet tall can be found on this side of the canyon. The cliff exists in the canyon bottom within the small side canyon between the proposed fan and pump house facilities and can be traced up the Left Fork to well beyond the end of the UP&L surveyed baseline (reference Figure 2.) The cliff has relatively recently experienced a significant joint plane failure resulting in a landslide just south of the proposed tank and pump house facility. Further hazard should be assessed here. To the northeast of the proposed fan facility, no outcrop was observed. From this point, the entire slope is blanketed by a thick layer of colluvial and debris. This material consists of varying proportions of clay, sand and gravel with boulders and sandstone block up to thirty feet across. One such block exists directly above

the proposed underground warehouse entry. Many of the blocks along the surface are meta-stable and their risk to personnel and property should be assessed. Seismic data indicates that the debris layer thickens toward the canyon floor. Borehole data indicates that the alluvial floor of the canyon consists of moderately compacted sandy gravel with boulders along with varying proportions of silt and clay.

At the confluence of the Left Fork and Rilda Canyon, two bedrock outcrops of a whitish sandstone exists just north of the existing road on the north side of Rilda Canyon. In order for this section of road to be readily accessible to truck traffic, these outcrops may need to be modified or the road should be realigned in order to avoid these outcrops. Of the two outcrops, the southwest outcrop is the tallest, rising to about 20 feet above the present roadway. At his point, the alluvial canyon floor is about 250 feet wide. No other significant constrictions by rock outcrop were observed within Rilda Canyon.

At the proposed leach field facility (~91+00 - 93+50) an outcrop of sandstone about 12 feet tall exists at the north corner of the leach field. This outcrop can be avoided by a minor readjustment of the leach field; however, the geometric characteristics of the bedrock below alluvial cover are not understood and further subsurface exploration may be required in this area.

This general area is located in Seismic Zone 2B in accordance with the Uniform Building Code.

2. *SUBSURFACE INVESTIGATION*

The characteristics of the subsurface material were defined, where possible, by drilling test borings varying in depth from 20 to 60 feet. The borings were drilled using a CME-55 rotary drill rig with water being used as the drilling fluid. The holes were advanced using a 2 15/16 inch rock bit and 3 inch NW casing. Samples were obtained in each test boring at three-foot intervals to a depth of 15 feet at five-foot intervals thereafter. Sampling was performed by driving a 2-inch split spoon sampling tube through a distance of 18 inches using a 140-pound weight dropped from a distance of 30 inches. The number of blows to drive the sampling spoon through each 6 inches of penetration is shown on the boring logs. The sum of the last two blow counts, which represents the number of blows to drive the sampling spoon through 12 inches, is defined as the standard penetration value. The standard penetration value provides a good indication of the in-place density of sandy-type material. Considerable care must be exercised in interpreting the standard penetration value in gravelly-type soils, particularly where the size of the granular particle exceeds the inside diameter of the sampling spoon. If the spoon can be

driven through the full 18 inches with a reasonable core recovery, the standard penetration value provides a good indication of the in-place density of gravelly-type material. The standard penetration value provides only an indication of the relative stiffness of cohesive-type soils, since the penetration resistance is a function of the moisture content.

Drill Holes 1 and 2 were drilled on opposite sides of Huntington Creek as shown in Figure 1. The logs for these test borings are presented in Figures 3 and 4, and it will be observed that the subsurface profile at these locations consisted predominately of granular-type soils. Drill Hole 1, which was drilled on the northeast side of the stream consisted of a surface layer of silty sand having organic material to a depth of approximately 2 feet underlain by brown sandy gravel and silty sandy gravel. A sandstone boulder was encountered between 28 and 32 feet followed by sandy gravel. The approximate elevation of this boring was 6892, while the approximate elevation of Huntington Creek is 6884. The material below a depth of 9 feet in this test boring is in a medium to dense state. It will be noted that water was encountered at a depth of approximately 8 feet below the ground surface.

Drill Hole 2 was drilled on the southwest bridge abutment with an approximate surface elevation of 6911. The subsurface profile consisted of a surface layer of silty sand with roots extending to approximately 2 feet underlain by granular soils. The subsurface materials to a depth of approximately 18 feet are in a low to medium dense state, while the material below 18 feet appears to be in a medium to dense condition. It will be observed that sand and silty sand layers were encountered between 8 and 11 feet and 30 to 38 feet. Boulders were encountered at 21, 42 and 55 feet in this boring. The groundwater level at this location was at a depth of approximately 22 feet below the ground surface.

Drill Holes 3 and 4 were drilled in the general area of the proposed leach field as shown in Figure 1. Drill Hole 3 was drilled 71 feet northeast of Station 93+55, while Drill Hole 4 was drilled 90 feet northeast of Station 91+87. The logs for these tests borings are presented in Figure 5, and it will be observed that the soil profile consists of brown gravelly silty sand to a depth of 8 feet in Drill Hole 3, underlain by silty sandy gravel with cobbles and boulders to a depth of 21 feet. The soil profile to a depth of 21 feet in Drill Hole 4 consisted of gravelly silty sand. In-place permeability tests were performed in these test borings at five-foot intervals following the procedures outlined in designation E-18 of the Bureau of Reclamation Earth Manual. The results of the permeability tests are also shown on the boring logs. It will be observed that the permeability rate of the gravelly silty sand varied from 44 to 836 feet per year, while the sandy gravel underlying the silty sand in Drill Hole 3 had a permeability rate exceeding 9400 feet per year. Complete water loss was encountered at 12.5 and 16 feet during drilling of this boring.

Drill Holes 5 and 6 were drilled in the general area of the proposed sediment pond as shown in Figure 1. Drill Hole 5 was drilled 36 feet south of Station 24+48, while Drill Hole 6 was

drilled 60 feet south of Station 21+55. The logs for these two test borings are presented in Figure 6, and it will be observed that the subsurface profile in this area consists of a surface layer of sandy silt and clay extending to a depth of 13 feet in Drill Hole 5 and 18 feet in Drill Hole 6 underlain by silty sandy gravel. Permeability tests were performed in each of these test borings and the results are also tabulated on Figure 6. Complete water loss was encountered during drilling of the sandy gravel material in each test boring.

Drill Holes 7 and 8 were drilled in the general area where parking is contemplated as shown in Figure 2. The grading plan for this area has not been finalized as of this date; however, it is anticipated that significant changing of the final contours will occur. Each of these borings encountered approximately 2 feet of dark brown silt with roots, underlain by granular material. The logs for these two borings are presented in Figure 7, and it will be observed that the subsurface profile below 2 feet in both borings consist predominately of silty sandy gravel to a depth of 21 feet, at which depth, the borings were terminated. The granular material in these borings is in a medium to dense state based upon the standard penetration values.

Drill Hole 9 was drilled in the general area of the proposed storage shed as shown in Figure 2. The log for this test boring is presented in Figure 8, and it will be noted that a dark brown silt extends to 1.5 feet and is underlain by granular material in a relatively dense state.

Drill Hole 10 was drilled as far uphill as access would permit in the bulk storage area to obtain general information relating to the subsurface materials throughout this area and to compare the bedrock elevation with that determined from the seismic refraction study. The boring extended to a depth of 51 feet without encountering bedrock. The soil profile, as presented in Figure 9, consisted of clay, sand and gravel with sandy clay layers and isolated boulders.

Drill Hole 11 was drilled in the vicinity of the surface shop as shown in Figure 2. The log for this boring is also presented in Figure 9, and it will be observed that the soil profile consists of a dark brown clayey silt to a depth of approximately 5 feet underlain by silty sandy gravel with a clayey sand layer between 12 and 15 feet. The standard penetration values indicate that the material to a depth of approximately 20 feet is in a relatively low density state. with material below 20 feet in a medium dense state.

Each sample obtained in the field was classified in the laboratory according to the Unified Soil Classification System. The symbol designating the soil type according to this system, is presented on the boring logs. A description of the Unified Soil Classification System is presented in Figure 10, and the meaning of the various symbols shown on the boring logs can be obtained from this figure.

3. *SEISMIC REFRACTION INVESTIGATION*

As stated earlier in this report, permitting requirements prohibited access to the south side of the Left Fork of Rilda Canyon where the mine portal approaches, water tank and pump house will be located. To obtain an indication of the bedrock profile throughout this general area, it was determined to perform seismic refraction surveys at the five proposed drill hole locations along the slope. In addition to the five lines on the south side of Left Fork, one seismic refraction line was located on the north side to assist in evaluating the depth to bedrock on this side of the canyon where the roadway is contemplated. The location of the seismic lines is presented in Figure 2.

LGS Associates, Inc., an engineering geophysical firm located in Salt Lake City, Utah, performed the seismic refraction survey under subcontract with RB&G Engineering, Inc. A complete copy of their report is included in the appendix of this report. The following paragraphs are taken from their results listed on page 3 of that report:

> "With two exceptions, the results of the seismic survey indicate a three-layer case throughout the site with each layer indicated by a distinct seismic velocity (density.) In general, the layering is interpreted as 1) a surficial low velocity (600 to 900 ft./sec.) 3 to 5 feet thick layer of aerated soil overlying; 2) an intermediate layer of generally medium dense colluvial soils of medium seismic velocity (200 to 2900 ft./sec.), which overlie; 3) bedrock. Exceptions to the above are the east end of Line 3 where the top low velocity layer does not exist, resulting in a two-layer case for that end of the line and Line 7, a four-layer case. Line 7 encountered an intermediate velocity layer of 1500 ft./sec. as the second layer. This line was located in the base of the drainage and this layer is thus interpreted as fine grained alluvium overlying the colluvial deposit. A distinct layer of alluvium was not indicated by the remainder of the lines for the following reason(s): 1) the alluvium is too thin to be identified as a distinct layer; 2) the alluvium is too limited in lateral extend; and/or; 3) the alluvium is about the same density (composition) as the colluvial soils.
>
> The seismic velocity of the bedrock ranges from about 6400 ft./sec. to 9200 ft./sec. The lower of these velocities are somewhat low for the massive sandstone observed in the area (i.e., estimate 9000 to 10,000 ft./sec.) These lower velocities are consistent with the presence and abundance, of open or soil filled, essentially vertical fractures in the massive sandstone bedrock or a bedrock type such as thin or medium bedded sandstones with interbedded shale, or shale."

This section also states that the depth to bedrock varied from 10 feet at the east end of Line 2 to over 100 feet at the east end of line 6. LGS and Associates estimate the depths to the layers to be within 10% of the actual depth.

The cross-sections at each seismic line location are presented in Figures 11 through 13. Also shown on these figures are the approximate locations of the mine facilities.

4. FIELD AND LABORATORY TESTS

Field and laboratory tests performed during this investigation to define the characteristics of the subsurface material throughout the proposed site were limited to standard penetration tests, Atterberg Limits and mechanical analyses. As stated in a previous section of this report, the standard penetration tests are recorded at each sampling location on the boring logs.

The results of mechanical analyses and Atterberg Limit tests performed on selected samples from each test boring are presented in Tables 1 through 4, Summary of Test Data. It will be observed from Table 1 that the percent of material in the silt and clay size range at the bridge structure varied from 0.5 to about 32% with all of the material classifying as granular-type soils.

Table 2 presents the results of tests performed in the leach field area and it is significant to note that the silty sand material has between 23 and 49% in the silt and clay size range.

The results of classification tests performed in the sediment pond area are presented in Table 3, and it is significant to note that the material in the upper 13 feet generally has more than 50% in the silt and clay size range. The fine grain material has low plasticity characteristics with a plasticity index ranging from 6 to 14.

Table 4 presents the summary of test data for tests performed on samples obtained from the drill borings extending up the Left Fork of Rilda Canyon. It is significant to note that the percent of material in the silt and clay size range varied from 14 to 64% with most of the samples having more than 30% in the silt and clay size range.

In-place permeability tests were performed in Drill Holes 3 through 6, and the results of these tests were discussed in Section 2, Subsurface Investigation.

5. DESIGN CONSIDERATIONS AND RECOMMENDATIONS

Based upon the information obtained during this investigation, the following design considerations and recommendations are made:

A. HUNTINGTON CREEK BRIDGE STRUCTURE

It is our understanding that the bridge contemplated for this site will have a double span with each span approximately 103 feet long. We understand that the width of the bridge will be approximately 30 feet. Figure Number 14 shows a location plan view and a bridge elevation of the proposed structure. The loads contemplated for this structure are not known as of preparation of this report. It is our opinion that deep foundations should be used to support the proposed facility at this site. Boring Number 1 was placed in the vicinity of Bent Number 2, as shown in Figure 14. It is apparent from the Boring Log that the subsurface profile consists of medium dense to dense silty sandy gravel below a depth of 9 feet. This boring was located approximately 8 feet above the stream bed. Recommended allowable soil bearing pressures for caissons extending 10 feet below the stream channel and 20 feet below the stream channel are tabulated below for various caisson diameters.

(1) *Bent Number 2 with shaft extending 18 feet to elevation 6874 (10 feet below stream bed).*

Caisson Diameter (Ft.)	Caisson Capacity (Tons)
2.0	22
2.5	32
3.0	45
3.5	60

(2) *Bent Number 2 with shaft extending 28 feet to elevation 6864.*

Caisson Diameter (Ft.)	Caisson Capacity (Tons)
2.0	41
2.5	58
3.0	78
3.5	101

In providing these capacities it has been assumed that the 8 feet of material above the stream bed is subject to erosion, hence no side resistance was allowed for this material. Boring Number 2 was placed on the southwest bridge abutment, identified as Bridge Abutment Number 1 in Figure 14. The approximate ground elevation at the drill location was 6911, which is about 27 feet above the stream bed. Consideration has been given to extending caissons to a depth of 20 feet with the caissons terminating in the silty sandy gravel with isolated boulders. A caisson at this level would be approximately 7 feet above the stream bed. Caissons at this level will require that sufficient protection be provided to prevent the possibility of erosion of the existing slope. A second alternative

is to extend the caissons to a depth of 40 feet to elevation 6871. It will be noted from the Boring Log that a sand layer exists between 29 and 38 feet below the ground surface and that the sandy gravel below this sand layer is in a medium dense state. Recommended allowable soil bearing pressures for caissons located as indicated above are tabulated below for various caisson diameters.

(3) *Southwest Bridge Abutment for Shaft Extending 20 feet to approximately elevation 6891.*

Caisson Diameter (Ft.)	Caisson Capacity (Tons)
2.0	46
2.5	62
3.0	80
3.5	100

(4) *Shaft extending 40 feet to approximate elevation 6871 (13 feet below stream bed).*

Caisson Diameter (Ft.)	Caisson Capacity (Tons)
2.0	134
2.5	179
3.0	229
3.5	284

For the preliminary design it is recommended that the caisson capacities shown in A above be used for the northeast Bridge Abutment Number 3. The caisson capacities have been estimated using procedures outlined in a publication entitled "Drill Shafts; Construction Procedures and Design Methods Prepared for the U.S. Department of Transportation" by Lyman Reese and Michael W. O'Neil. The allowable soil bearing pressures assume a factor of safety of 2.5. Since the overburden material consists of granular type soils with a small amount of fines, casing will be required to maintain stability of the hole during the caisson construction. If the caisson hole can not be maintained in a completely dewatered condition, filling the hole with concrete must be performed using a tremie type operation. Care should be taken in placing the concrete so that the tremie is always maintained at a depth of at least 2 feet in the concrete while the casing is being removed. It is recommended that a competent engineer familiar with caisson construction be present at the site to inspect the caisson installation.

B. PROPOSED LEACHFIELD AREA

At the present time the leachfield is contemplated to be on the north side of the baseline somewhere between Station 91+00 and Station 93+50. Test borings Number 3 and Number 4 indicate that the soil profile consists of gravelly silty sand underlain by silty sandy gravel with cobbles and boulders. The gravelly silty sand has between 23 and 49 percent in the silt size range. In test boring 3 this material extended to a depth of 8 feet and the underlying sandy gravel was highly pervious. It is our opinion that the gravelly silty sand will serve as an excellent medium for the leachfields with percolation rates in the range of 10 minutes per inch. The gravel zone underlying the silty sand in Test Boring Number 3 is too pervious to serve as an absorption field and will have a percolation rate smaller than 4 minutes per inch. The leach field should be located as far as possible away from the sandstone outcrop near the northerly corner of the area. Once the final location of the leachfield has been established, we recommend that percolation tests be performed in accordance with State and Local building codes within the leachfield area.

C. SEDIMENT POND

While the exact location of the sediment pond has not been established, it is anticipated that the pond will be between Station 21+00 and 25+00 along the existing baseline. Test Borings Number 5 and 6 indicate that the subsurface profile to a depth of approximately 15 feet in this general area consists of material having nearly 50 percent in the silt and clay size range. This material is underlain by highly pervious silty sandy gravel. It should also be noted that the material in the upper portion of the profile is in a relatively loose density state and that the permeability rate of this material varied from 31 to 1600 feet per year. It is our opinion that a liner will be required for the sediment pond if seepage loses are to be controlled. The material in the upper 15 feet of the Test Borings will serve satisfactorily as filter material for a clay liner and as good bedding material for a synthetic liner. No source of clay was identified in the Rilda Canyon area which would serve satisfactorily as a liner. It is anticipated that a suitable clay source could be found near Huntington. It is our opinion that a 2 foot thick clay liner using a low to medium plasticity clay would result in a permeability rate in the order of 1 foot per year (1×10^{-6} cm per second). If a lower rate is required, we recommend that consideration be given to a synthetic liner such as EPDM or Hypalon.

The configuration of the sediment pond is also not known as of the preparation of this report. If an impoundment structure is used, it is recommended that the embankments be designed using slide slopes of the 3 horizontal to 1 vertical upstream and 2 horizontal to 1 vertical downstream.

D. PARKING AREAS

It is contemplated that an employee parking lot will be constructed near the westerly end of the Left Fork of Rilda Canyon as shown in Figure Number 2. Test Holes 7 and 8 were drilled in this general area and it will be observed from the boring logs that a dark brown silt with roots extends to a depth of approximately 2 feet. This material should be removed from the area prior to placement of compacted fill or flexible pavement. The underlying silty sandy gravel is in a medium to dense state and will serve as an excellent subgrade for flexible pavement. Where this material is encountered at the subgrade level, it is recommended that the upper 10 inches be scarified, moisture conditioned and redensified to an in-place unit weight equal to at least 90 percent of the maximum laboratory density as determined by ASTM D1557-78. Boulders should be removed within the upper 10 inches of the subbase material. If this action is taken, we recommend that a CBR value of 20 be used for the subbase in computing the flexible pavement design. Assuming that the parking lot traffic will be limited to passenger type vehicles and light trucks, it is recommended that the flexible pavement consist of scarifying and redensifying the silty sandy gravel followed by a 4 inch leveling course of untreated granular base and a 2 ½ inch asphalt surface course. The granular base course should be densified to 95 percent of the maximum density as determined by ASTM D1557-78. The gradation characteristics of the base should conform to the following gradation specifications:

SIEVE SIZE	PERCENT PASSING
1 INCH	100
½ INCH	70-100
NO. 4	41-68
NO. 16	21-41
NO. 50	10-27
NO. 200	4-13

In order to preserve the gradation of the granular base, we recommend that percent wear of this material be less than 50 when tested in accordance with AASHTO T-96. Mineral aggregates used in the asphalt surface course should conform to Section 402 of the Standard Specifications of the Utah State Department of Transportation. Mixing, placing and densification of all asphalt material should also conform to UDOT Standards. If rigid pavement is contemplated for this area, we recommend that a 3 to 4 inch leveling course be placed on the compacted subgrade followed by a 4 inch thick pavement. This again, assumes that parking lot traffic is limited to passenger type vehicles and light trucks.

E. STORAGE SHED

The exact dimensions and loads for the storage shed to be located as shown in Figure Number 2 are not known as of the preparation of this report. It is anticipated, however, that the loads will be relatively light and that the structure will be supported using continuous and spot footings. All footings should extend to a depth sufficient to provide frost protection, which is about 3 ½ feet in this area. Based on Boring Number 9, the surface dark brown silt should be stripped from the building site. The underlying material is granular, capable of supporting moderate load intensities. We recommend that an allowable soil bearing pressure of 2500 pounds per square foot be used in designing the footings for the storage shed, except that in no case should the footings be less than 20 inches in width.

F. SURFACE SHOP

Boring Number 11 defines the soil characteristics at the proposed location for the surface shop. It is recommended that the upper 2 feet of dark brown silt be excavated to remove excess organic matter from beneath the building pad. If footings are placed at a depth sufficient to provide frost protection it is apparent that the footing level would exist in the dark brown clayey silt shown in Boring Number 11. We recommend that no footings be placed directly on this material. We recommend that either the footings extend down to the brown sandy silty gravel at a depth of 5 feet or that the dark brown clayey silt be removed in the footing areas and replaced with compacted granular fill. If this option is selected, the width of the compacted fill should be at least twice the width of the footing. The on-site silty sandy gravel can be used as compacted fill provided that it is placed in lifts not exceeding 1 foot and compacted to an in-place density equal to at least 95 percent of the maximum density as determined by ASTM D1557-78.

If the above recommendations are complied with an allowable soil bearing pressure of 2000 pounds per square foot can be used for the shop area, except that no footing should be less than 20 inches in width.

G. PRELIMINARY DESIGN INFORMATION FOR CUT SLOPES, EARTH RETAINING FACILITIES AND THE ELEVATOR SHAFT.

As stated earlier in this report, access restrictions prohibited drilling of the 5 test borings for the mine facilities along the south side of the Left Fork of Rilda Canyon. Seismic refraction lines ran at these 5 locations and detailed geologic mapping was performed to obtain information for preliminary design. The slope of the canyon wall is relatively steep with average slopes ranging from 31° to 36°. Test Boring and sampling was performed primarily in the alluvial materials at the base of the Canyon. No sampling

and testing was performed on the overburden colluvial materials. For a preliminary design, we recommend that the assumption be made that the colluvial material is similar in nature to the material at the base of the canyon. This material has a significant portion in the silt and clay size range. Borings Number 10 and Number 11 for example, have between 33 to 64% in this range. It is our opinion that this amount of fine grain material will increase the cohesion, resulting in an increase of the shearing strength of this material. We recommend that for preliminary design purposes, cut slopes of 1 horizontal to 1 vertical be used where materials of this type exist. If following sampling and testing of the colluvial material, it is determined that it is primarily granular, the cut slopes may need to be flattened to 1.5 horizontal to 1 vertical.

During the final design, when the shearing strength parameters of the subsurface materials are more fully known and when the location of the cut slopes have been finalized, slope stability computations should be performed to determine the cut slopes.

Cuts in the overburden for portals will require earth retaining structures. We recommend that the earth pressures be calculated using the following equation:

$$P = \tfrac{1}{2} K \gamma H^2$$

where P = total lateral force on the wall, plf
K = earth pressure coefficient
γ = unit weight of the soil (115 pcf)
H = height of the wall

The earth pressure coefficient used in designing the retaining structures will depend upon the slope of the overburden material above the structure. For slopes in excess of 30°, it is recommended that an active earth pressure coefficient of 0.75 be used to calculate the lateral earth pressures. Because of the sandstone blocks existing in the overburden, we do not believe that sheet piling is a viable alternative for the support structures. One alternative would be to use drilled caissons extending through the overburden and into the bedrock. Stabilization of the cliff above the proposed pump house and water tank should be performed prior to construction to prevent rock falls from damaging these structures. It appears that this can be accomplished using a combination of flattening the slope and rock bolting across the joints. The overburden material appears capable of supporting the pump house and water tank; however, test borings will be required at these locations prior to construction to evaluate bearing capacity and settlement characteristics of the overburden.

For the preliminary design of the elevator shaft, we recommend that the above equation be used assuming a lateral earth pressure coefficient at rest, which based on information obtained to date,

will be about 0.5. Final design recommendations for lateral earth pressures will be provided once the characteristics of the overburden materials are more fully defined.

As stated in the geology section of this report, several of the large sandstone blocks existing on the south side of the canyon are in a meta-stable condition and are subject to movement downslope during development of the facilities. Stabilization of these areas will be required where development takes place. The depth to bedrock, based upon the two seismic refraction lines at the location of the proposed elevator shaft, is approximately 75 feet. During final design of the mine facilities in Rilda Canyon, it is essential that test borings be drilled at the portal entries, the pump house, water tank and elevator shaft locations to determine the characteristics of the overburden material. Seismic Refraction Line 5 was placed on the north side of the Left Fork of Rilda Canyon to assess the depth to bedrock where access roads are contemplated. It will be noted from Figure 13 that bedrock is encountered within a depth of between 10 and 15 feet at the upper bound of the refraction line.

The conclusions and recommendations presented in this report are based upon the results of field and laboratory tests performed during this study. We consider the geotechnical investigation on the south side of the Left Fork of Rilda Canyon to be preliminary in nature and recommend that test borings be placed along this slope to define the characteristics of the overburden material when access becomes available. It is our opinion that the seismic refraction lines provide a reasonable indication of the depth to bedrock and will assist in preliminary design of these facilities.

We appreciate the opportunity of performing this initial study for you. If there are any question relative to the information contained herein, please contact our office.

Sincerely,

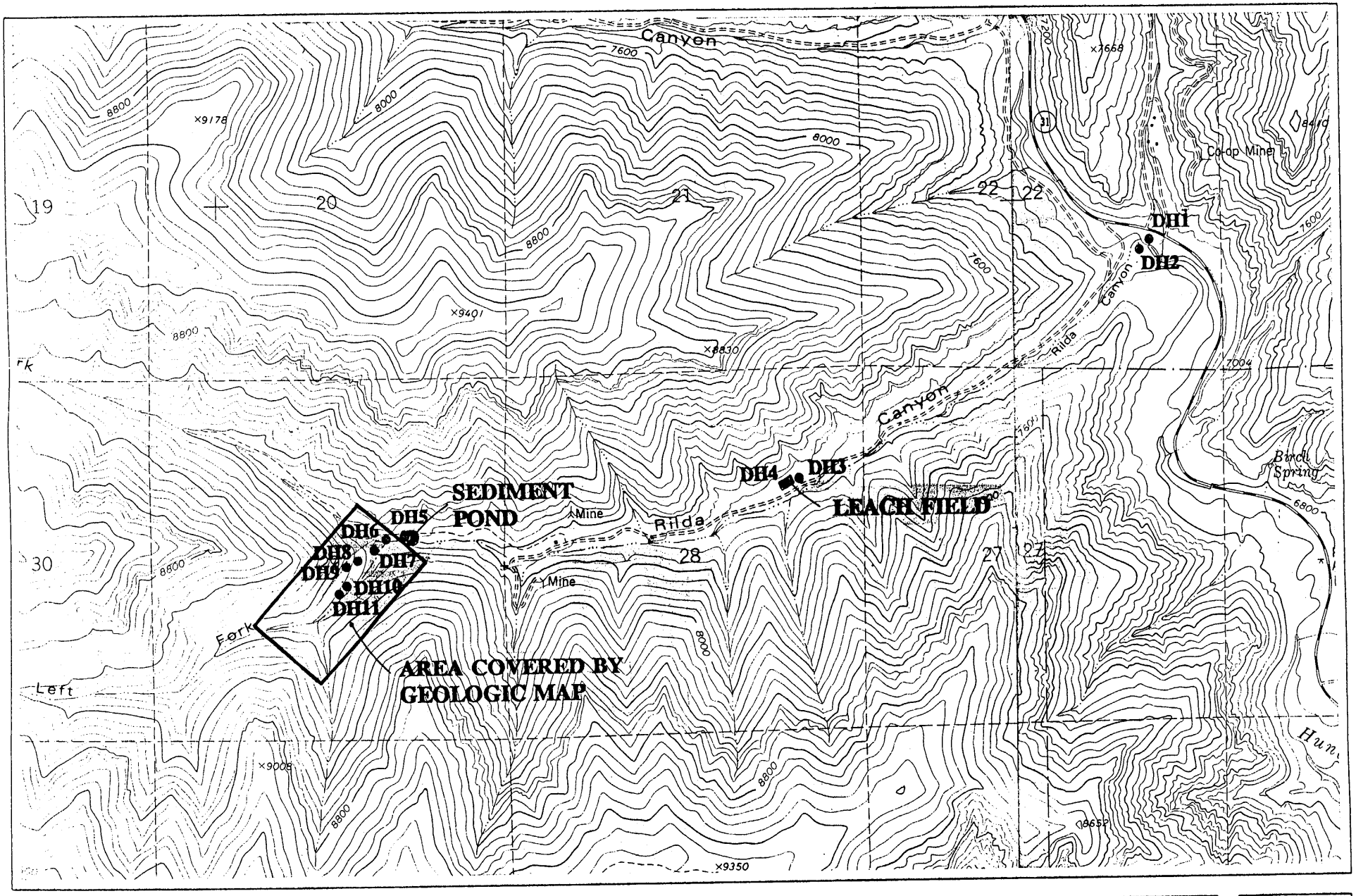
RB&G ENGINEERING, INC.

Bradford E. Price, P.E.

Ralph L. Rollins, Ph.D., P.E.

bep/jag

Figures



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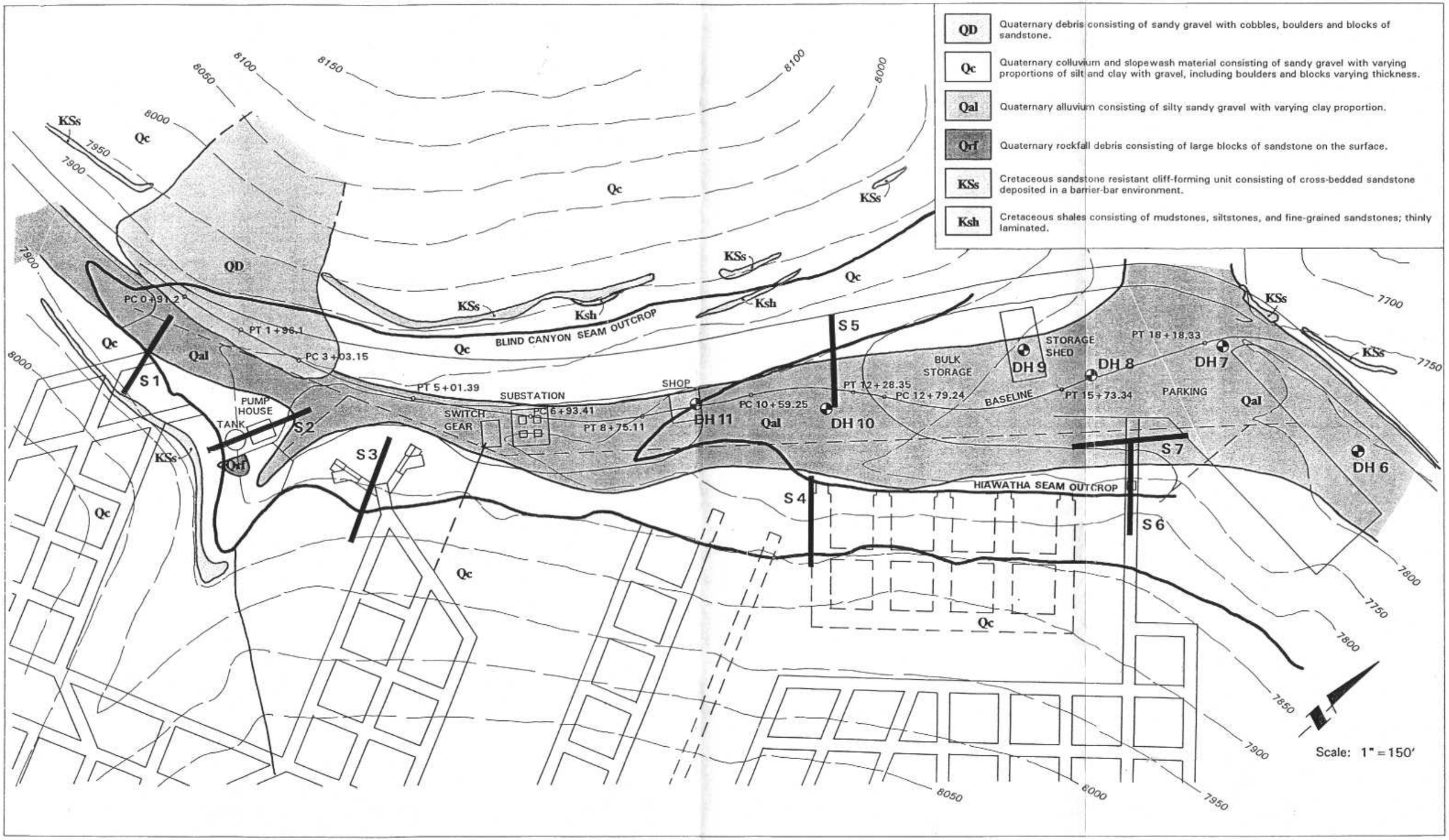
VICINITY MAP
Rilda Canyon Mine Facilities
Emery County, Utah

FIGURE NO. 1



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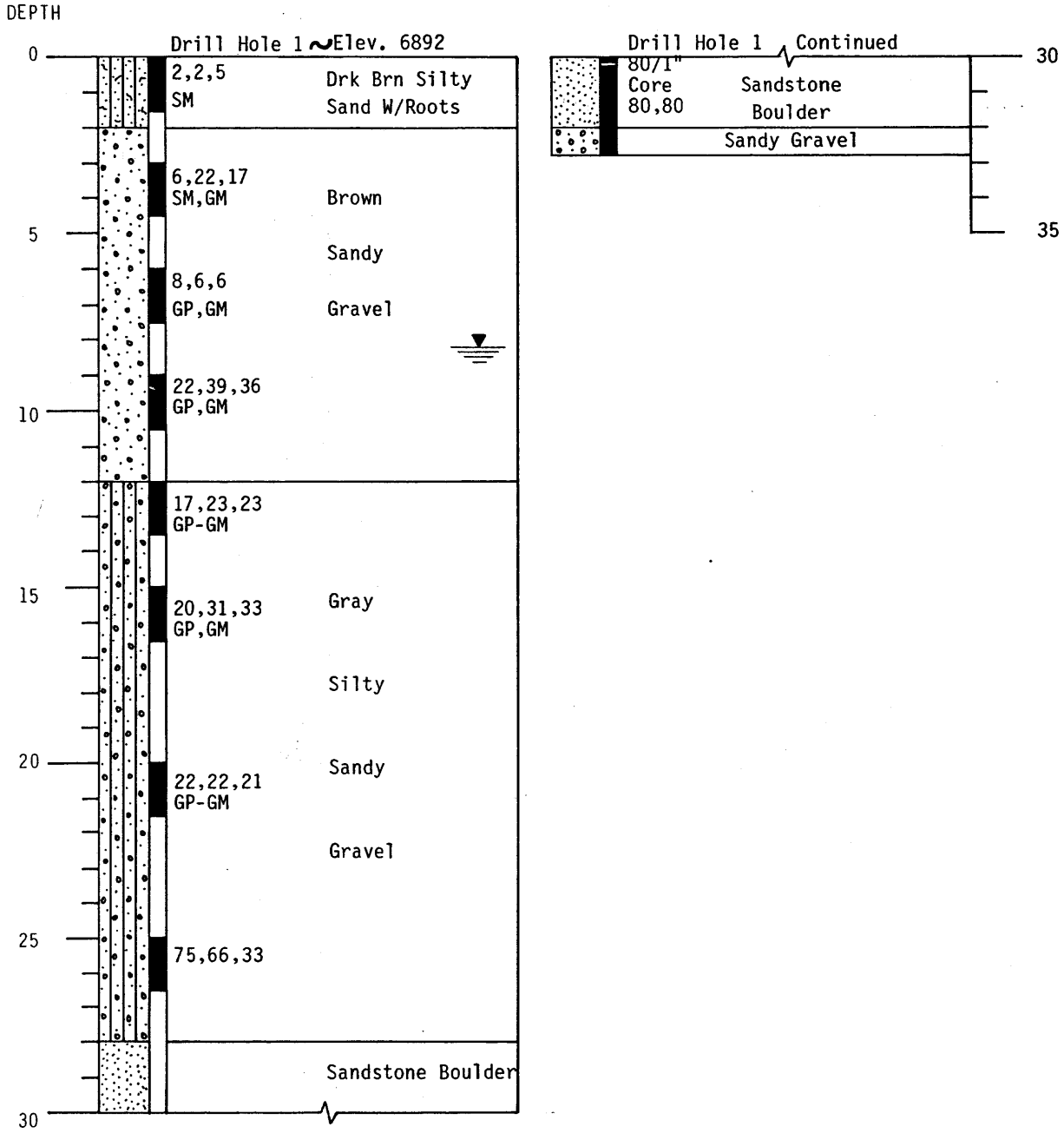
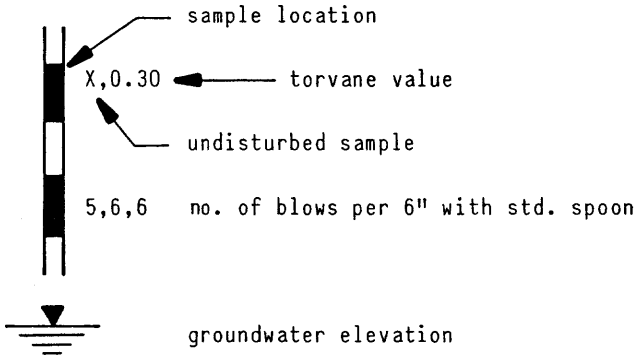
RILDA CANYON MINE FACILITIES
Emery County, Utah

GEOLOGIC MAP
Bore Hole and Seismic Line Locations

FIGURE 2



LEGEND



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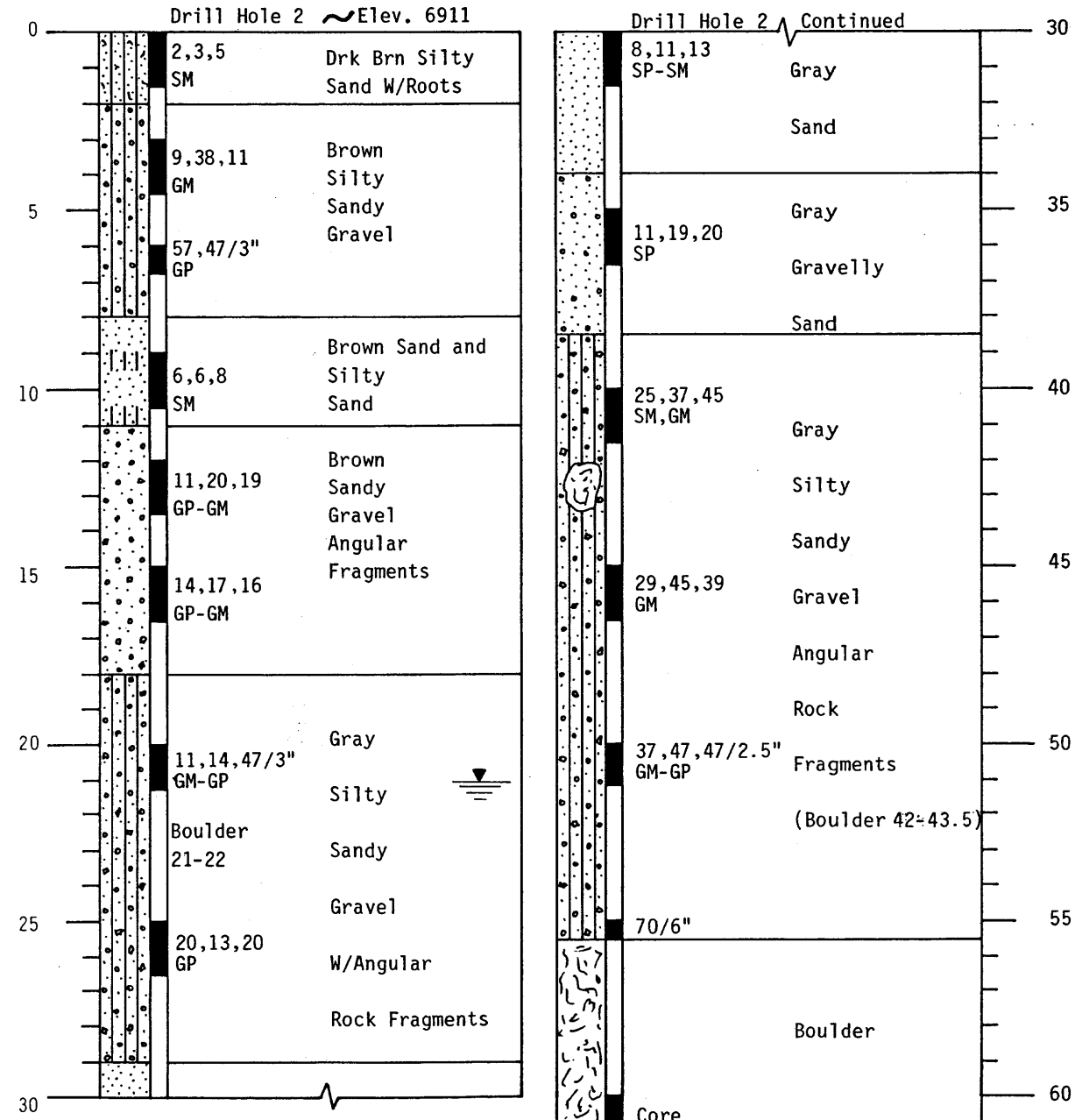
Log of Borings for:
Rilda Canyon Mine Facilities
Near Bent #2
Northeast side of stream

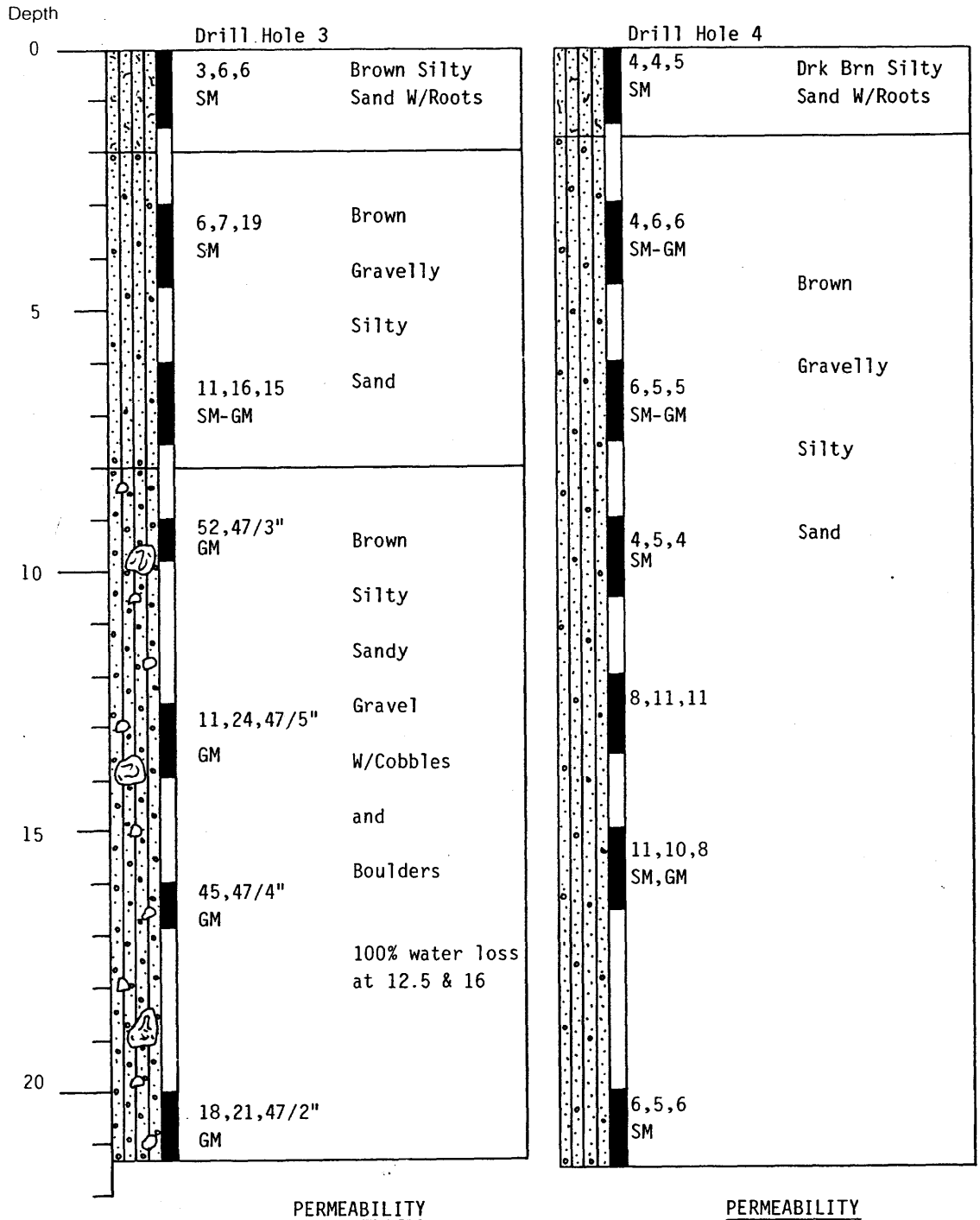
Figure No. 3



ROLLINS, BROWN AND GUNNELL, INC.
PROFESSIONAL ENGINEERS

Log of Borings for:
Rilda Canyon Mine Facilities
Southwest Bridge Abutment

Figure No. 4



PERMEABILITY

DEPTH (ft)	RATE (ft/yr)
0-5	249
5-10	330
10-15	13200*
15-20	9430*

PERMEABILITY

DEPTH (ft)	RATE (ft/yr)
0-5	148
5-10	44
10-15	125
15-20	836

* Exceeds Pump Capacity of 20 GPM

ROLLINS, BROWN AND GUNNELL, INC.
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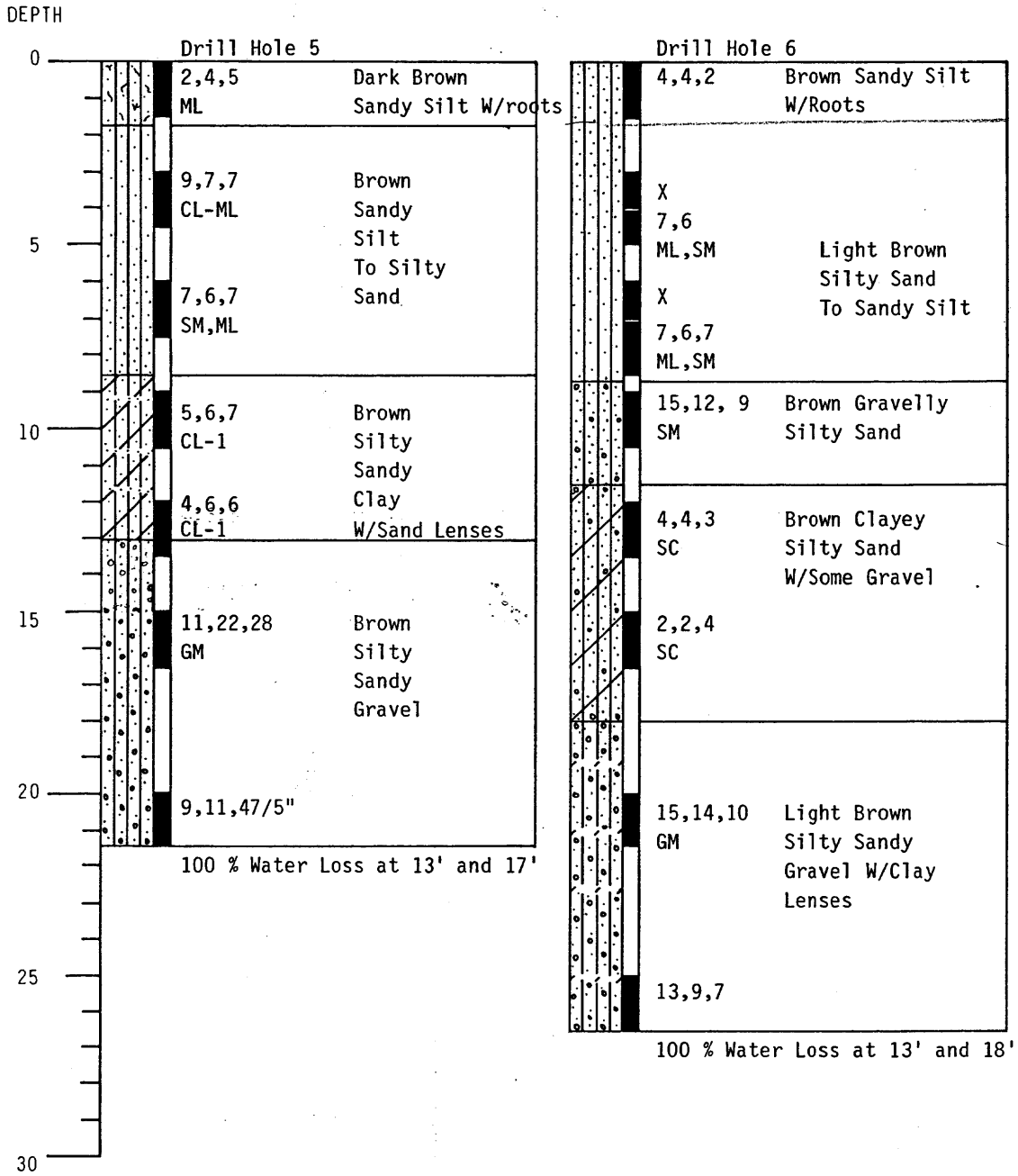
Log of Borings for:
Rilda Canyon Mine Facilities
Leach Field Area

Figure No. 5



Permeability	
Depth(ft)	Rate(ft/hr)
0-5	347
5-10	1619
10-15	13200*
15-20	9400*

Permeability	
Depth(ft)	Rate(ft/yr)
0-5	62
5-10	31
10-15	7300*
15-20	5400*
20-25	4200*

*Exceeded Capacity of Pump.

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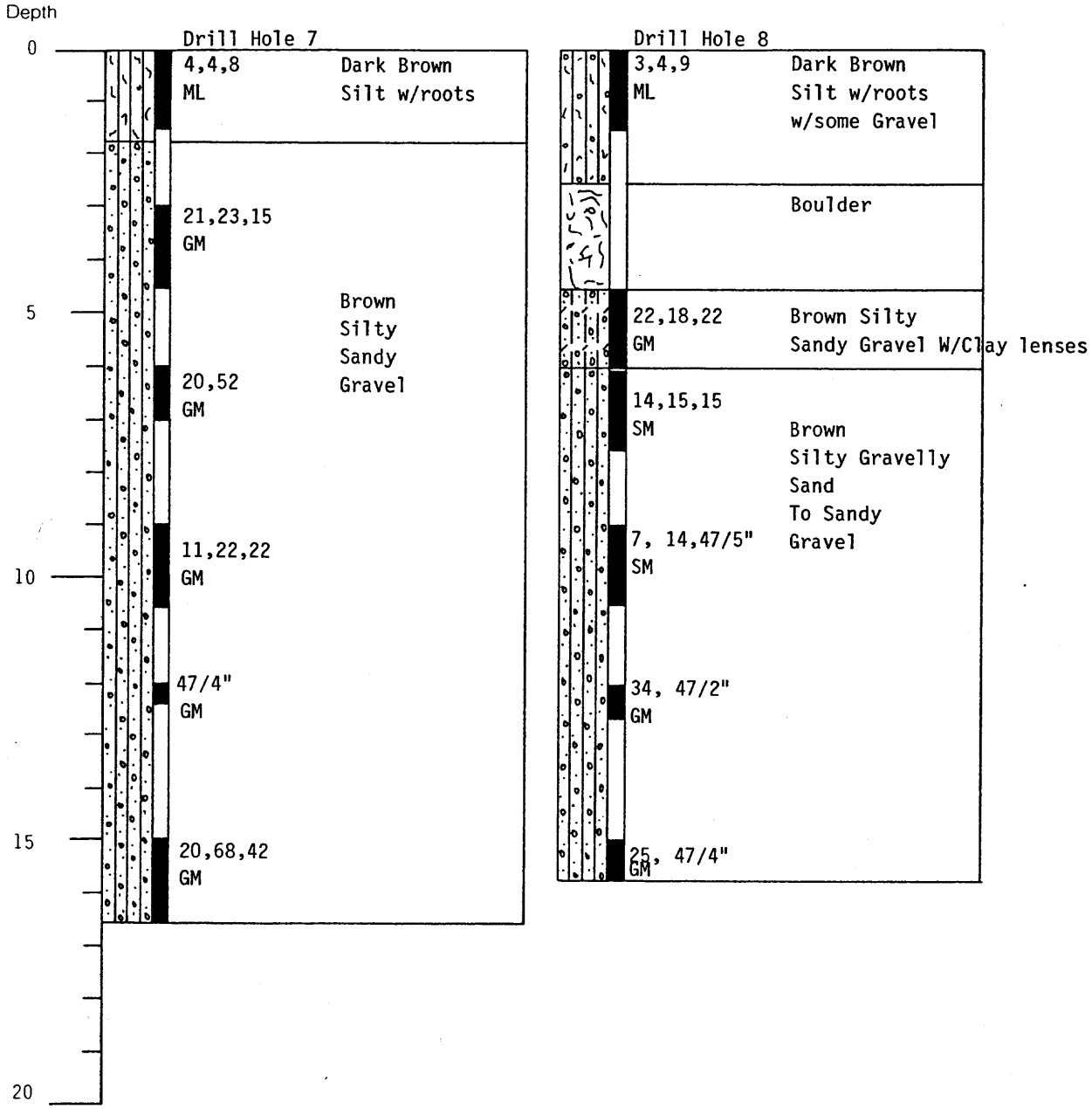
Log of Borings for:
Rilda Canyon Mine Facilities
Sediment Pond Area

Figure No. 6



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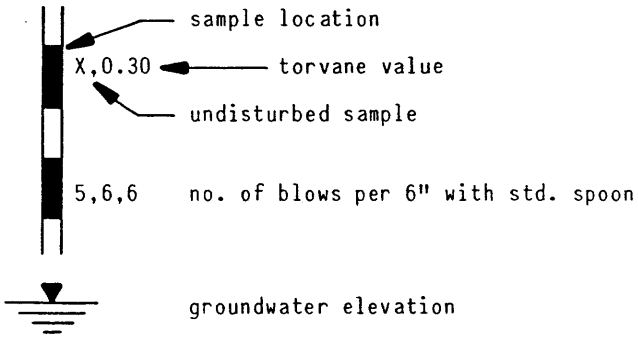

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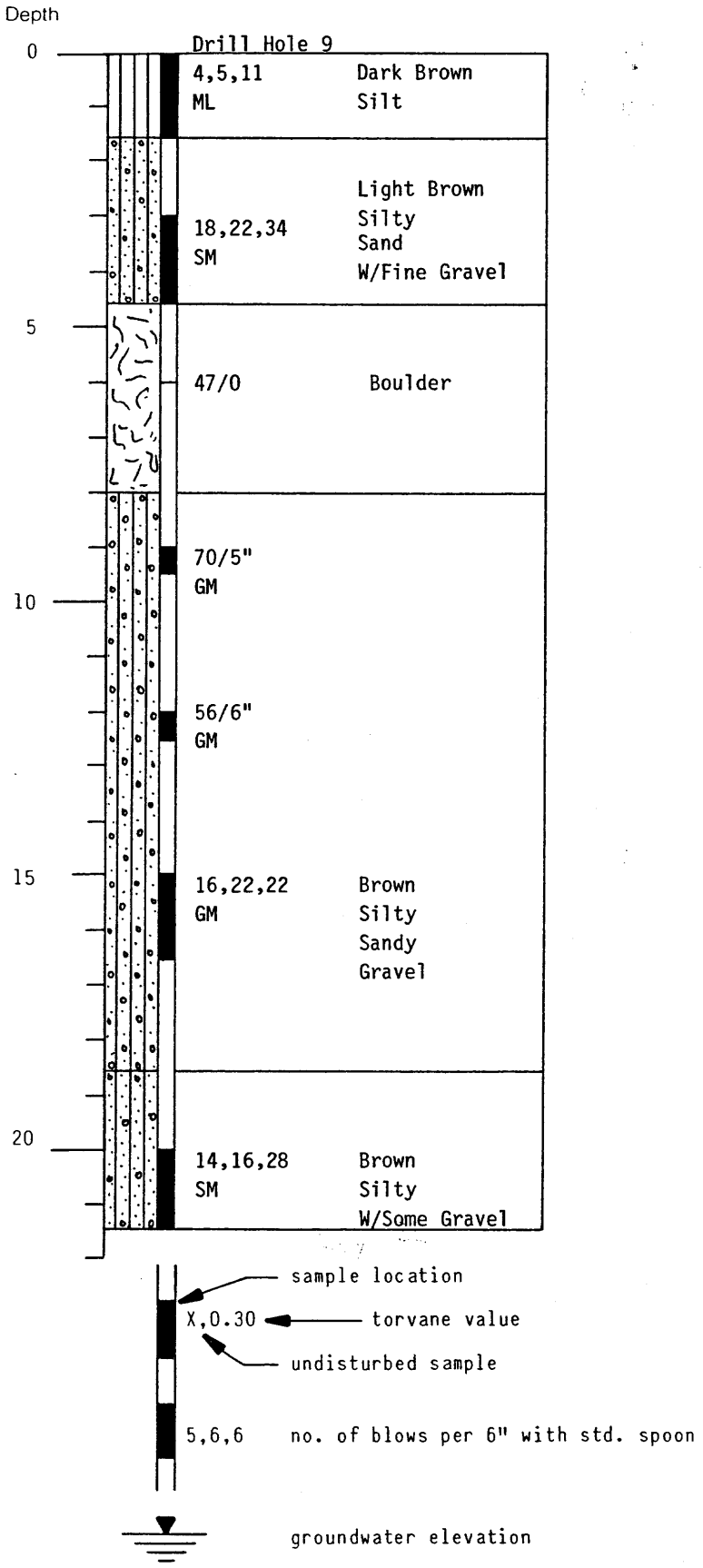
Log of Borings for:
Rilda Canyon Mine Facilities
Parking Area

Figure No. 7



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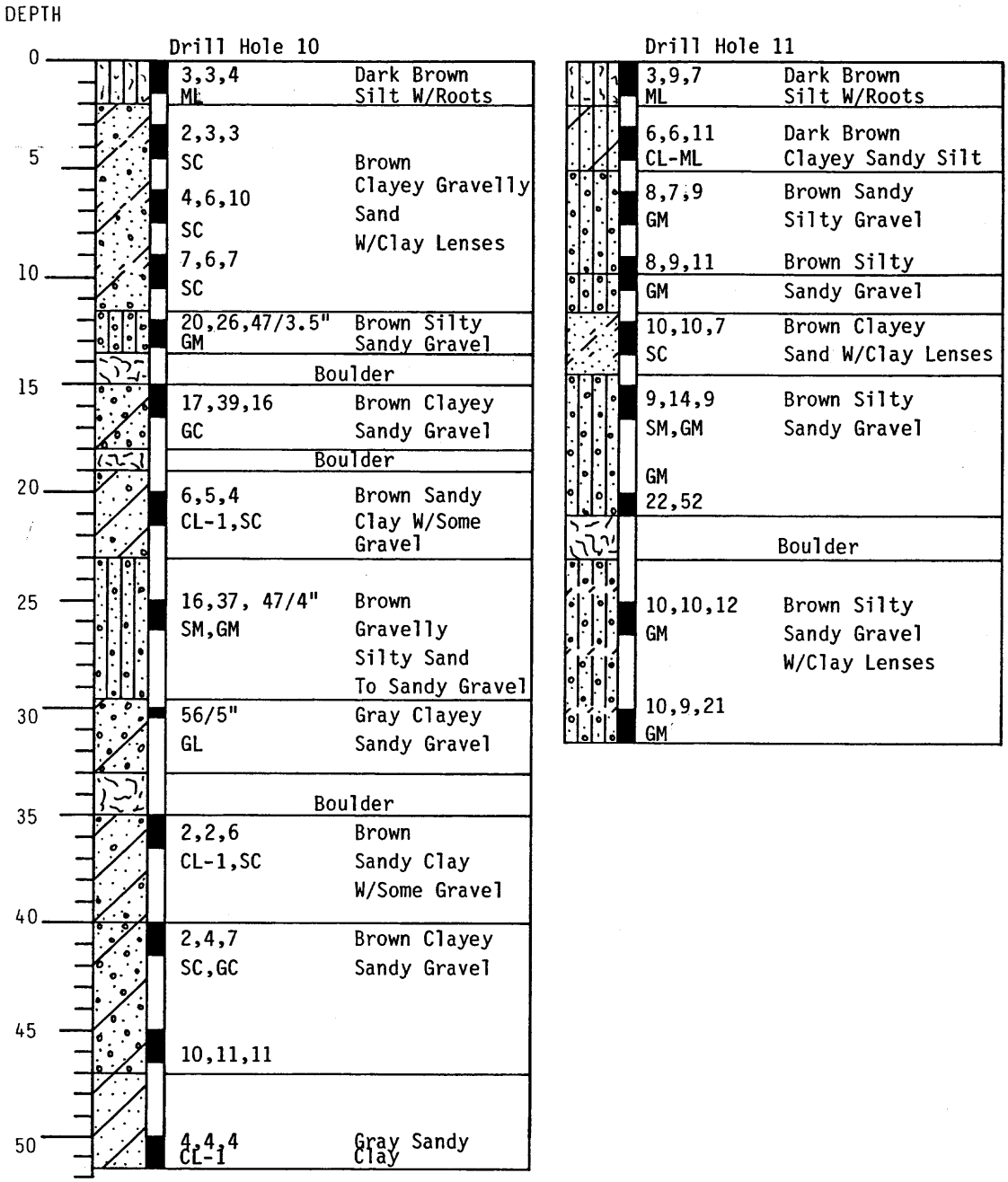
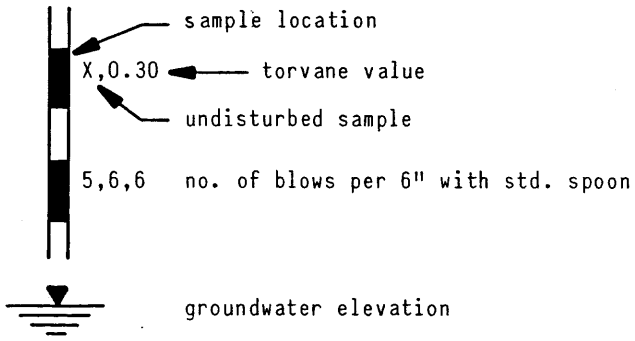
Log of Borings for:
Rilda Canyon Mine Facilities
Storage Shed

Figure No. 8



LEGEND



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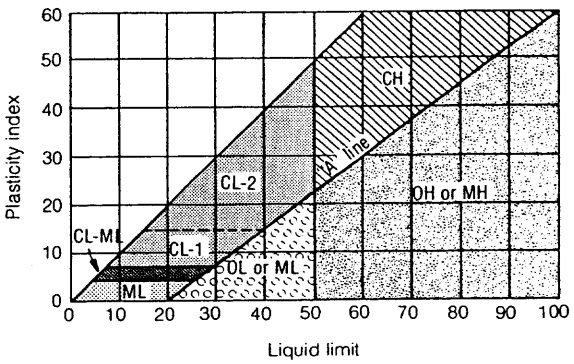
Log of Borings for:
Rilda Canyon Mine Facilities
Bulk Storage and Surface Shope

Figure No. 9

Unified Soil Classification System

Major Divisions			Group Symbols	Typical Names	Laboratory Classification Criteria		
Course-grained Soils More than half of material is *larger* than No. 200 sieve	Gravels More than half of coarse fraction is larger than No. 4 sieve size	Clean Gravels (Little or no fines)	GW	Well graded gravels, gravel-sand mixtures, little or no fines.	Determine percentage of gravel and sand from grain size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows: Less than 5% ..... GW, GP, SW, SP More than 12% ..... GM, GC, SM, SC 5% to 12% ..... Borderline cases requiring use of dual symbols**	$C_u = \frac{D_{60}}{D_{10}}$ Greater than 4 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines		Not meeting all gradation requirements for GW	
		Gravels with fines (Appreciable amount of fines)	GM* d u	Silty gravels, poorly graded gravel-sand-clay mixtures		Atterberg limits below "A" line, or *PI* less than 4	Above "A" line with *PI* between 4 and 7 are *borderline* cases requiring uses of dual symbols
			GC	Clayey gravels, poorly graded gravel-sand-clay mixtures		Atterberg limits above "A" line, or *PI* greater than 7	
	Sands More than half of coarse fraction is smaller than No. 4 sieve size	Clean Sands (Little or no fines)	SW	Well graded sands, gravelly sands, little or no fines		$C_u = \frac{D_{60}}{D_{10}}$ Greater than 6 $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
			SP	Poorly graded sands, gravelly sands, little or no fines.		Not meeting all gradation requirements for SW	
		Sands with fines (Appreciable amount of fines)	SM* d u	Silty sands, poorly graded sand-silt mixtures		Atterberg limits below "A" line, or *PI* less than 4	Above "A" line with *PI* between 4 and 7 are *borderline* cases requiring uses of dual symbols
			SC	Clayey sands, poorly graded sand-clay mixtures		Atterberg limits above "A" line, or *PI* greater than 7	
Fine-grained Soils More than half of material is *smaller* than No. 200 sieve	Silt and Clays Liquid limit less than 50		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity			
			CL 1 2	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays			
			OL	Organic silts and organic silt-clays of low plasticity			
	Silts and Clays Liquid limit greater than 50		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts			
			CH	Inorganic clays of high plasticity, fat clays			
			OH	Organic clays of medium to high plasticity, organic silts			
Highly Organic Soils			Pt	Peat and other highly organic soils			

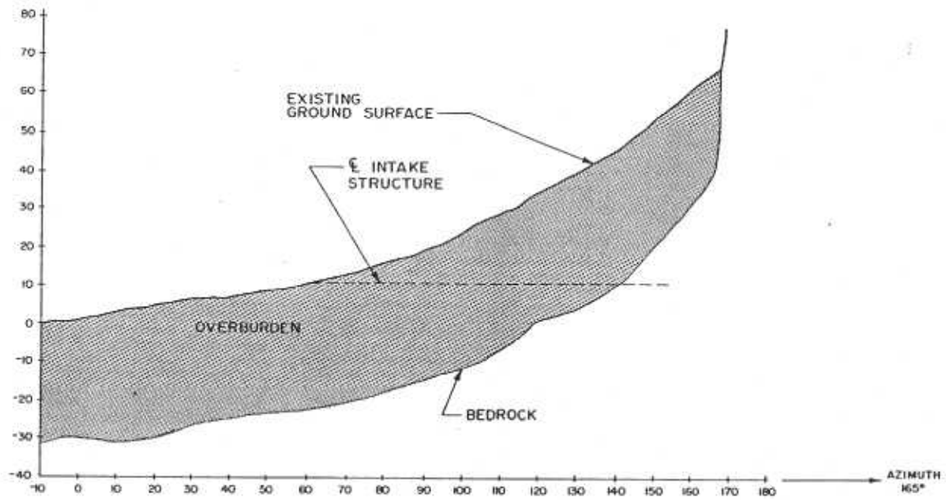


Plasticity Chart
For laboratory classification of fine-grained soils

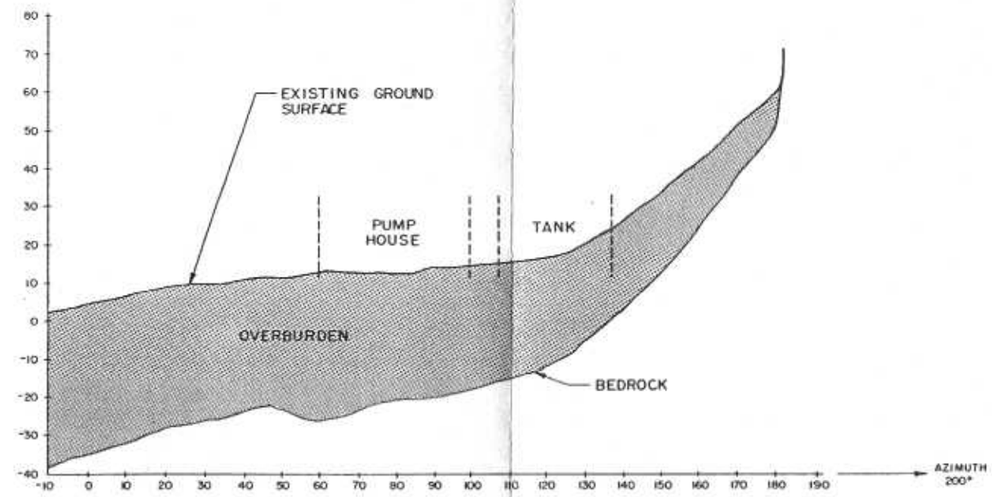
*Division of GM and SM groups into subdivisions of *d* and *u* for roads and airfields only. Subdivision is based on Atterberg limits; suffix *d* used when liquid limit is 28 or less and the *PI* is 6 or less, the suffix *u* used when liquid limit is greater than 28.

***Borderline classification*: Soils possessing characteristics of two groups are designated by combinations of group symbols. For example *GW-GC*, well graded gravel-sand mixture with clay binder.

Figure No. 10

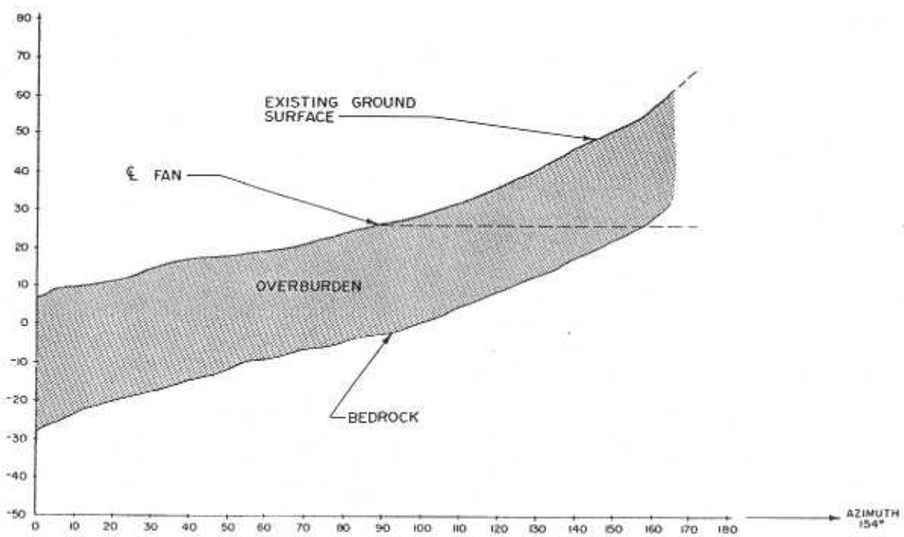


SEISMIC LINE NO. 1



SEISMIC LINE NO. 2

SEISMIC LINE NO. 3



DATE	BY	REVISIONS

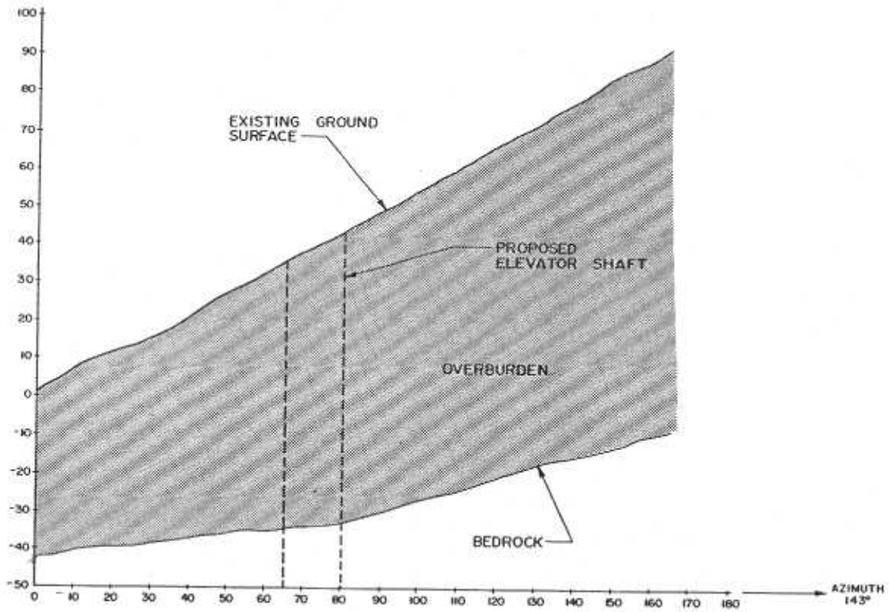
DESIGNED BY DATE
DRAWN BY DATE
CHECKED BY DATE

ROLLINS, BROWN AND GUNNELL, INC.
PROFESSIONAL ENGINEERS

RILDA CANYON MINE FACILITIES

SEISMIC REFRACTION LINES

FIGURE 11



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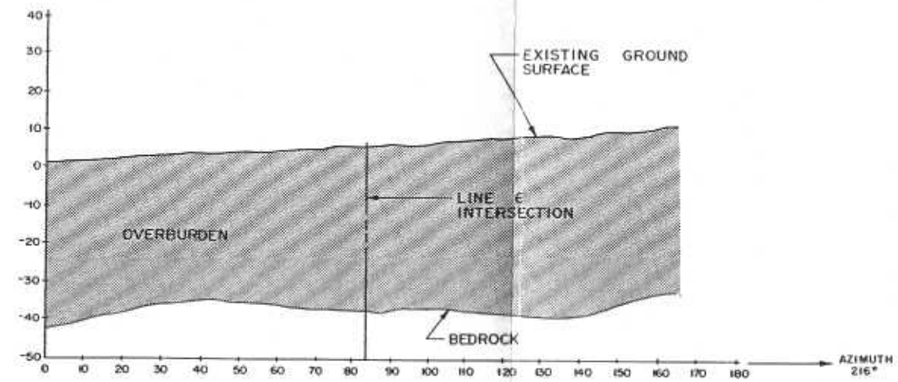
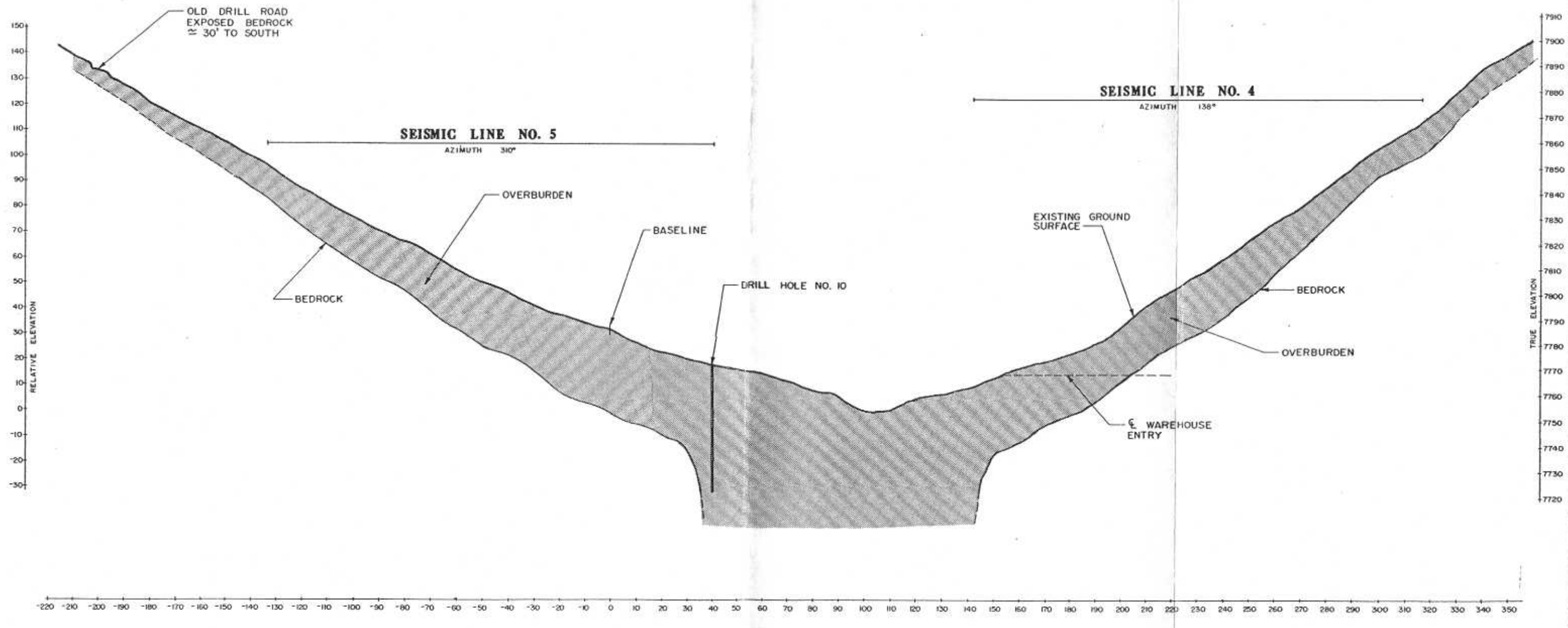


SEISMIC LINE NO. 7

DESIGNED BY	DATE	ROLLINS, BROWN AND GUNNELL, INC. PROFESSIONAL ENGINEERS	RILDA CANYON MINE FACILITIES
DRAWN BY	DATE		
FIELD CHECK BY	DATE		

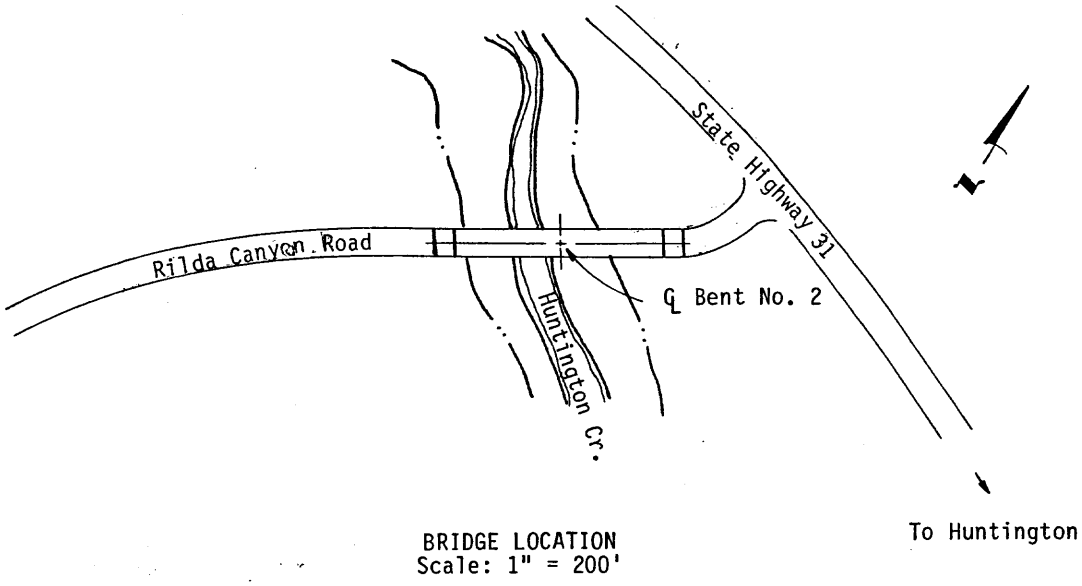
SEISMIC REFRACTION LINES

FIGURE 12

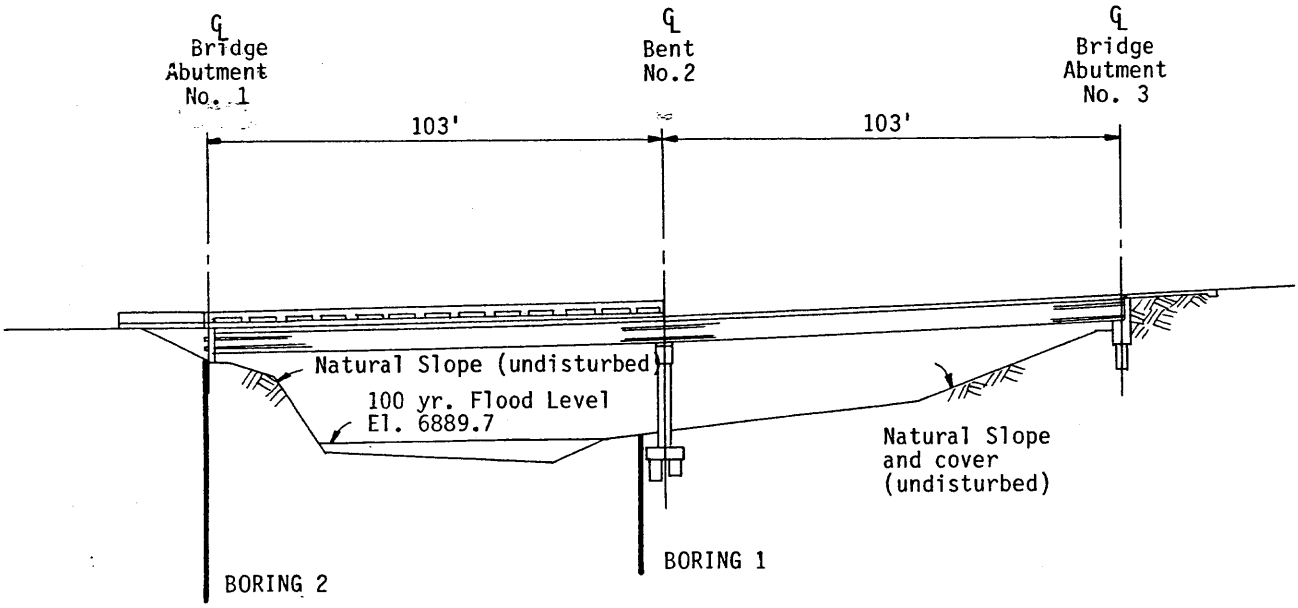


SEISMIC LINE NO. 4 & NO. 5
AZIMUTH 132°

DATE BY REVISIONS	DESIGNED BY DATE DRAWN BY DATE CHECKED BY DATE	ROLLINS, BROWN AND GUNNELL, INC. PROFESSIONAL ENGINEERS	RILDA CANYON MINE FACILITIES	SEISMIC REFRACTION LINES	FIGURE 13 OF SHEETS



BRIDGE LOCATION
Scale: 1" = 200'



BRIDGE ELEVATION
No Scale

RB&G ENGINEERING INC. Provo, Utah

Figure 14. BRIDGE ACROSS HUNTINGTON CREEK

Rilda Canyon Facilities
Emery County, Utah

Tables

Table 1

SUMMARY OF TEST DATA

PROJECT Rilda Canyon

LOCATION Bridge Structure FEATURE Foundations

HOLE NO.	DEPTH BELOW GROUND SURFACE	STANDARD PENETRATION BLOWS PER FOOT	IN-PLACE		UNCONFINED COMPRESSIVE STRENGTH (psf)	CONSISTENCY LIMITS			MECHANICAL ANALYSIS			UNIFIED SOIL CLASSIFICATION SYSTEM (modified)
			DRY UNIT WEIGHT (pcf)	MOISTURE (%)		LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	PERCENT GRAVEL	PERCENT SAND	PERCENT SILT & CLAY	
1	3-4.5′	39							35.5	44.5	20.0	SM,GM
	6-7.5′	12							67.2	24.7	8.1	GP,GM
	9-10.5′	75							66.4	26.9	6.7	GP,GM
	12-13.5′	46							48.6	43.5	7.9	GP,GM
	15-16.5′	64							65.6	27.9	6.5	GP,GM
2	6-7.5′	57/6" 47/3"							56.4	43.1	0.5	GP
	9-10.5′	14							1.3	66.9	31.8	SM
	12-13.5′	39							48.9	37.8	13.3	GP,GM
	20-21.5′	14/6" 47/3"							65.2	23.7	11.1	GM,GP
	30-31.5′	24							0	87.9	12.1	SP,SM
	40-41.5′	82							32.2	45.4	22.4	SM,GM

NP=Nonplastic

Table 2

SUMMARY OF TEST DATA

PROJECT Rilda Canyon

LOCATION Leach Field Area FEATURE Foundations

HOLE NO.	DEPTH BELOW GROUND SURFACE	STANDARD PENETRATION BLOWS PER FOOT	IN-PLACE		UNCONFINED COMPRESSIVE STRENGTH (psf)	CONSISTENCY LIMITS			MECHANICAL ANALYSIS			UNIFIED SOIL CLASSIFICATION SYSTEM (modified)
			DRY UNIT WEIGHT (pcf)	MOISTURE (%)		LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	PERCENT GRAVEL	PERCENT SAND	PERCENT SILT & CLAY	
3	3-4.5′	26							14.5	62.6	22.9	SM
	6-7.5′	31							18.4	43.6	38.0	SM,GM
	9-10.5′	52/6" 47/3"							58.7	24.0	17.3	GM
	12.5-14′	24/6" 47/5"							46.3	17.8	35.9	GM
4	3-4.5′	12							19.5	31.5	49.0	SM,GM
	6-7.5′	10							21.2	35.7	43.1	SM,GM
	9-10.5′	9							26.0	39.0	35.0	SM,GM
	15-16.5′	18							28.0	28.6	43.4	SM,GM

NP=Nonplastic

Table 3

SUMMARY OF TEST DATA

PROJECT Rilda Canyon

LOCATION Sediment Pond FEATURE Foundations

HOLE NO.	DEPTH BELOW GROUND SURFACE	STANDARD PENETRATION BLOWS PER FOOT	IN-PLACE		UNCONFINED COMPRESSIVE STRENGTH (psf)	CONSISTENCY LIMITS			MECHANICAL ANALYSIS			UNIFIED SOIL CLASSIFICATION SYSTEM (modified)
			DRY UNIT WEIGHT (pcf)	MOISTURE (%)		LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	PERCENT GRAVEL	PERCENT SAND	PERCENT SILT & CLAY	
5	3-4.5′	14				23	17	6				CL-ML
	6-7.5′	13							1.0	50.5	48.5	SM,ML
	9-10.5′	13				27	17	10				CL-1
	12-13.5′	12				27	18	14				CL-1
6	4.5′	13							8.7	38.3	53.0	ML,SM
	7-8.5′	13							2.9	45.3	51.8	ML,SM
	9-10.5′	21							28.5	45.7	25.8	SM

NP=Nonplastic

Table 4

SUMMARY OF TEST DATA

PROJECT Rilda Canyon

LOCATION Parking Area, Storage Shed, Bulk Storage Area, Surface Shop

FEATURE Foundations

HOLE NO.	DEPTH BELOW GROUND SURFACE	STANDARD PENETRATION BLOWS PER FOOT	IN-PLACE		UNCONFINED COMPRESSIVE STRENGTH (psf)	CONSISTENCY LIMITS			MECHANICAL ANALYSIS			UNIFIED SOIL CLASSIFICATION SYSTEM (modified)
			DRY UNIT WEIGHT (pcf)	MOISTURE (%)		LIQUID LIMIT (%)	PLASTIC LIMIT (%)	PLASTICITY INDEX (%)	PERCENT GRAVEL	PERCENT SAND	PERCENT SILT & CLAY	
7	3-4.5′	38							49.3	32.6	18.1	GM
	6-7′	72							46.1	39.7	14.2	GM
	9-10.5′	44							51.5	32.5	16.0	GM
8	4.5-6′	40							52.9	28.1	19.0	GM
	6-7.5′	30							14.6	51.4	34.0	SM
	9-10.5′	14/6" 47/5"							12.6	52.0	35.4	SM
9	3-4.5′	56							20.4	45.7	33.9	SM
	12-12.5′	56/6"							41.2	34.3	24.5	GM
10	9-10.5′	13							18.4	55.6	26.0	SC
	20.21.5′	9				28	17	11	10.4	25.7	63.9	CL-1,SC
	30-30.5′	56/5"							26.1	38.5	35.4	GC
	40-41.5′	11							28.3	36.5	35.2	SC,GC
	50-51.5′	8				28	18	10	16.9	49.5	33.6	CL-1,SC
11	3-4.5′	17				23	17	6				CL-ML
	6-7.5′	16							39.1	26.8	34.1	GM
	9-10.5′	20							35.1	28.4	36.5	GM
	12-13.5′	17							7.4	49.1	43.5	SC

NP=Nonplastic

Appendix

RESULTS OF SEISMIC REFRACTION INVESTIGATIONS AT RILDA CANYON, EMERY COUNTY, UTAH

Prepared For: Rollins, Brown & Gunnel
Provo, Utah

Prepared By: LGS & Assoc. Inc.
Salt Lake City, Utah

November 26, 1991

INTRODUCTION

Presented in this report are the results of our refraction seismic survey within Rilda Canyon, Emery County, Utah. The canyon is accessed from Huntington Canyon, at approximately three miles above the Huntington Power Plant in Huntington Canyon. The purpose of the survey was to determine the depth and profile of the subsurface bedrock at locations specified by the Client.

SITE DESCRIPTION

Each of the sites were located on moderate to very steep side slopes of Rilda Canyon. Outcrops of medium to thick bedded sandstone of the Blackhawk (?) formation are predominant in the area and the underlying bedrock at the six sites is thus assumed to be sandstone. Large blocks of sandstone occur commonly on the slopes and rock of similar and smaller size is assumed to occur in the colluvial soils of silty sand with gravel which comprise the overburden overlying the bedrock. Minor alluvial deposits are evident in and near the canyon bottom and appear to consist of generally unsorted, fine to coarse material.

FIELD INVESTIGATIONS

Procedures:

Field investigations were conducted from November 6 to 10, 1991. The general site area investigated begins approximately three miles from the mouth of Rilda Canyon and extends for about one mile further up the canyon. Six sites were investigated within this area, at locations shown on Figure 1. Two seismic lines were located at the elevator site, due to the excessive depth to bedrock encountered at that site and one line each was completed at

the remaining five sites. Each seismic lines consisted of 12 geophones, placed in line at 15 ft. intervals. Each geophone was placed in a small diameter, 4 to 6 in. deep hole, beneath the generally very loose surface soil and/or root zone, to obtain solid coupling of the phone with the more firm, underlying soil. The total line lengths, bearings and locations with respect to field reference stakes are presented on Table I of this report. Relative elevations were obtained, by hand level, for all shot points and geophone stations to establish a datum for the subsequent seismic data reduction. The elevations of the field reference stakes were also leveled in, relative to the appropriate seismic line.

Repeated hammer impacts, against a steel plate placed on the ground surface, were used as the energy source for the entire survey to utilize the signal enhancement feature of the seismograph. Four to five shot points were recorded at each profile to obtain redundancy of the data recorded. The data was digitized and recorded by a laptop computer in the field for subsequent processing in the office.

Equipment Used:

A Geometrics 1225F, 12 channel, signal enhancement seismograph, equipped with filters with a 0 to 400 Hz range, and 8.5 Hz geophones, was used in the data collection. A 16 lb. sledge hammer, striking a steel plate, on the ground surface, was used as the energy source.

OFFICE PROCEDURES:

Data reduction, analyses and presentations were computer assisted. Delay times and an iterative ray tracing procedure were used in determining the depths to the various subsurface layers and the bedrock topography. The depths to bedrock were verified by a second analytical procedure which was based on both the critical distance and the seismic velocities obtained from the time-

distance curves. Elevation changes in the ground surface along each seismic line, determined by hand leveling, were compensated for by making a least squares fit of the ground surface cross section, adding or subtracting the difference in feet, divided by the first layer velocity (to obtain the difference in time), of those geophone stations below or above the line. These time differences were then added, for phone stations below the line, or subtracted, for those stations above the line, from the original arrival times determined at each geophone station. The layer thickness were then determined beneath each corrected phone station and subsequently beneath each phone station of the restored cross section of the ground surface for the final plot. These elevation, or weathering, adjustments are made for all seismic waves that are refracted but are not required for the direct wave arrivals (first arrivals from the surface layer). The data was then presented as a computer printed cross section (Appendix A) of the subsurface immediately beneath each seismic line, showing the ground surface, contacts between the layers encountered and the bedrock topography, together with their respective elevations. The layer depths beneath the geophones are also summarized in tabular form, together with their respective, computed seismic velocities (Appendix B).

RESULTS:

Results of the investigations are presented as cross sections of the subsurface with the elevations and approximate depths of the layers shown (Figures A-1 to A-7, Appendix A). The computed depths of the layers and the seismic velocities used to determine these depths are presented on Figures B-1 to B-4, Appendix B.

With two exceptions, the results of the seismic survey indicate a three layer case throughout the site with each layer indicated by a distinct seismic velocity (density). In general, the layering is interpreted as: 1) a surficial, low velocity (600 to 900 ft./sec.) 3 to 5 ft. thick layer of aerated soil overlying; 2) an intermediate layer of generally medium dense colluvial soils, of medium

seismic velocity (2000 to 2900 ft./sec), which overlie; 3) bedrock Exceptions to the above are the east end of line 3, where the top low velocity layer does not exist, resulting in a 2 layer case for that end of the line and Line 7, a 4 layer case. Line 7 encountered an intermediate velocity layer of 1500 ft./sec. as the second layer. This line was located in the base of the drainage and this layer is thus interpreted as fine grained alluvium overlying the colluvial deposit. A distinct layer of alluvium was not indicated by the remainder of the lines for the following reason(s): 1) the alluvium is too thin to be identified as a distinct layer; 2) the alluvium is too limited in lateral extent; and/or; 3) the alluvium is about the same density (composition) as the colluvial soils.

The seismic velocity of the bedrock ranges from about 6400 ft./sec. to 9200 ft./sec. The lower of these velocities are somewhat low for the massive sandstone observed in the area (i.e., estimate 9000 to 10,000 ft./sec.). These lower velocities are consistent with the presence and abundance, of open or soil filled, essentially vertical fractures in the massive sandstone bedrock or a bedrock type such as thin or medium bedded sandstones with interbedded shale, or shale.

The aerated soil referred to above is, in our interpretation, the general lower limit of which air entrained by surface water percolation can be carried. Subsequent evaporation and organic activity presumably contribute to the aeration. This zone is not usually equivalent to a topsoil or weathered zone, however.

The range in depths to bedrock varied from 10 ft. (east end of Line 2 to over 100 ft. (east end of Line 6).

The presence of groundwater was not indicated by the investigations.

COMMENTS:

A typical seismic line at this site results in a depth determina-

tion at 12 to 15 ft. intervals along the bedrock surface. Variations in the depth can be occur between each of these points. A line connecting these points (beneath the geophone locations) therefore represents an averaging of the configuration of the refractor surface of interest (i.e., bedrock, at this site). Redundancy of the field data, a requirement for acccurate depth determinations and obtained by the use of multiple shot points in the field, is never fully achieved in sites underlain by steeply dipping bedrock or, the inverse, by steep slopes over relativly horizontal bedrock. Due to these considerations, we estimate the depths to the layers presented in Appendixes A and B to be within 10 percent of the actual depths.

We have appreciated the opportunity to provide this service to you. Please contact us if there are any questions or if you need addtional information.

Respectfully
LGS & Assoc. Inc.

LaMonte G, Sorenson
Principal

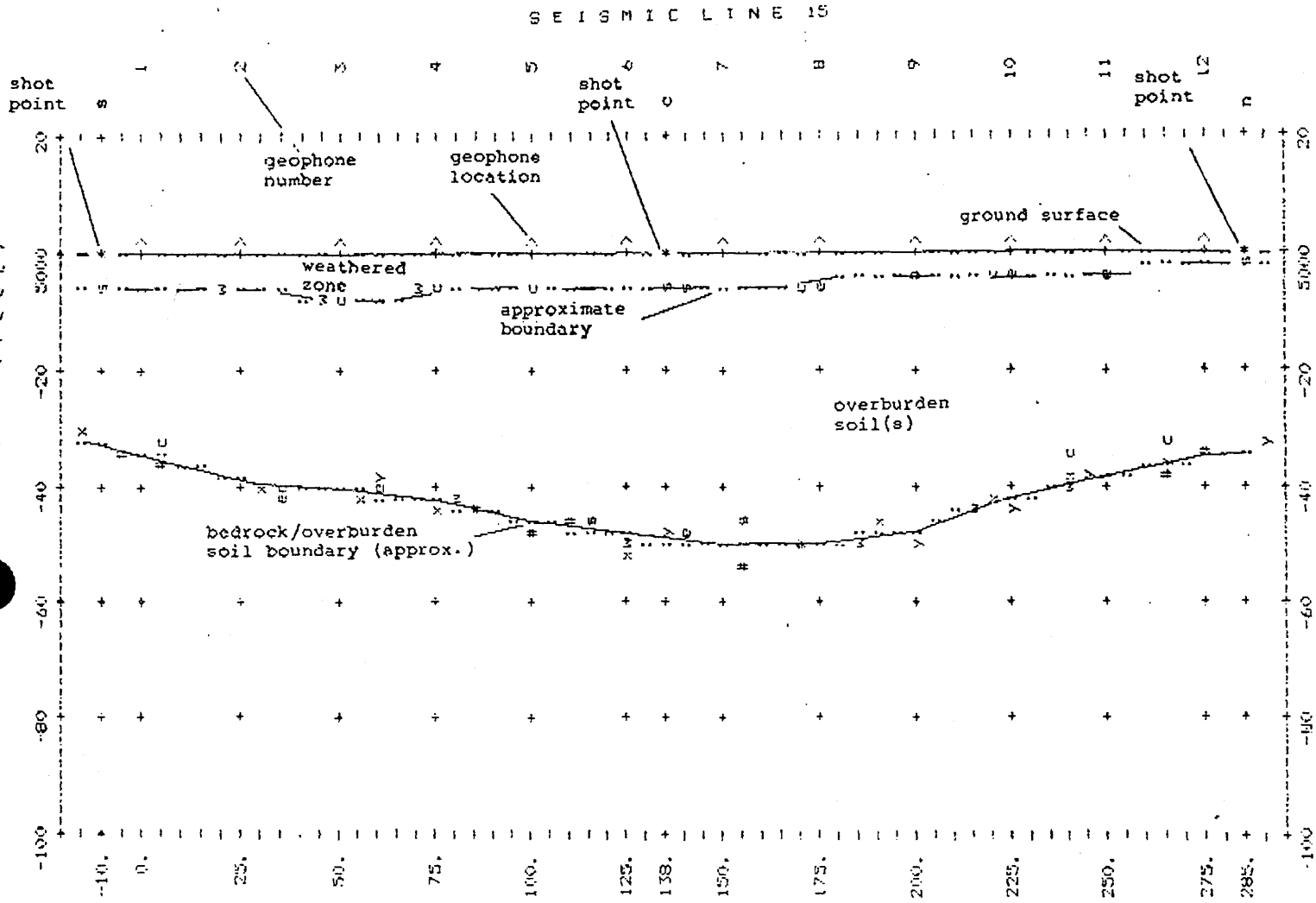
TABLE I

SEISMIC LINE	AZIMUTH (deg)	TOTAL LENGTH* (ft.)	ELEV.** (ft.)	LOCATION W/ RESPECT TO RB&G FIELD STAKE
1	165	175	2.5	stake @ phone 1 (stake move 10 ft W. of orig. location)
2	200	175	7	stake is 20 ft E. of E. sho point (E. end of line)
3	154	185	12.5	stake is 3 ft W. of phone 3 (phone 9 is at FAN stake)
4	138	175	4.5	stake is 3 ft W. of phone 2 (WHSE PORTAL stake betw.3&4
5	310	185	0	stake is 8 ft W. of E. shot point
6	143	185	0	stake is at W. shot point
7	216	185	6	midpoint of line is at W. end (shot point) of Line 6

*typical line length at this site is 185 ft., as measured between each end sho point (SP). Each SP is typically 10 ft beyond the end phone. Lines less than typical are due to a perpendicular offset of a shot point, due to topography, wwhich is not included in the total line length.

**elevation relative to the respective seismic line.

EXPLANATION



Horizontal distance along seismic line (ft). For the above example, the line length from the south to the north shot points is 295 ft (-10 to 285 ft).

s c n indicates shot points at the south, center and north ends
* * * of the seismic line.

Scale: as presented on the x and y axis of each cross section.

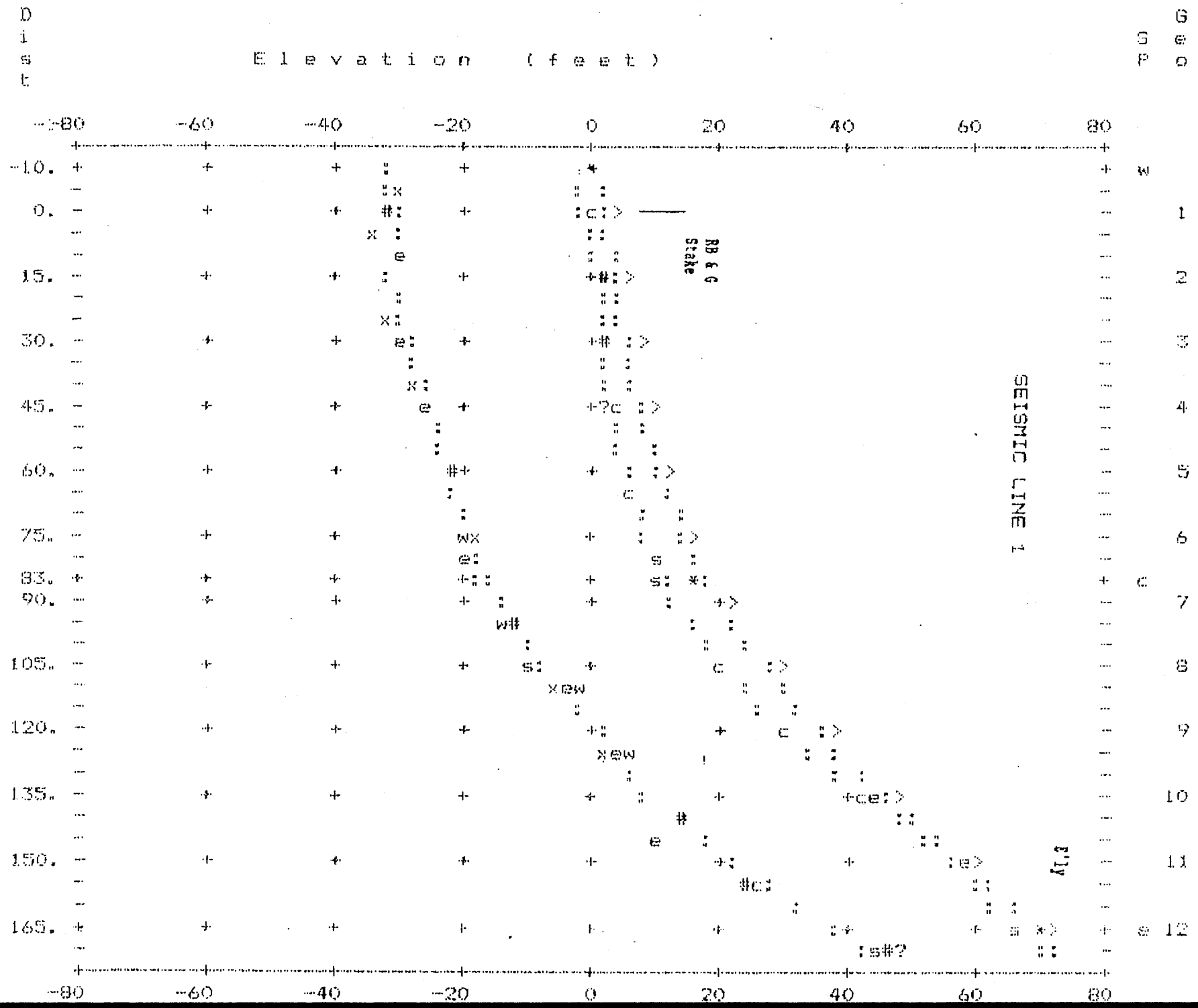
Seismic Velocity of Materials Encountered: Refer to Appendix B.

TYPICAL INTERPRETED SUBSURFACE CROSS SECTION

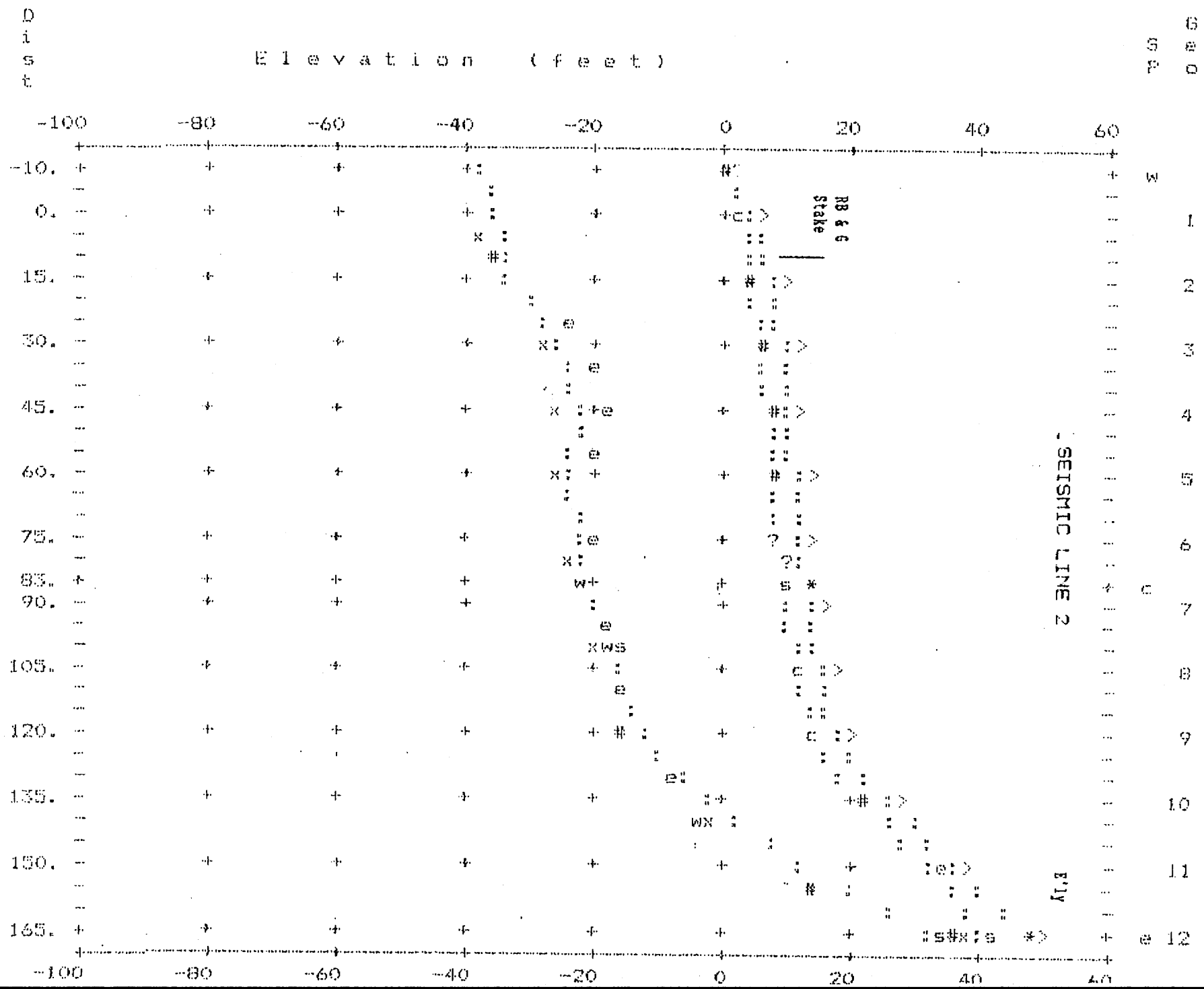
APPENDIX A

INTERPRETED SUBSURFACE CROSS SECTIONS

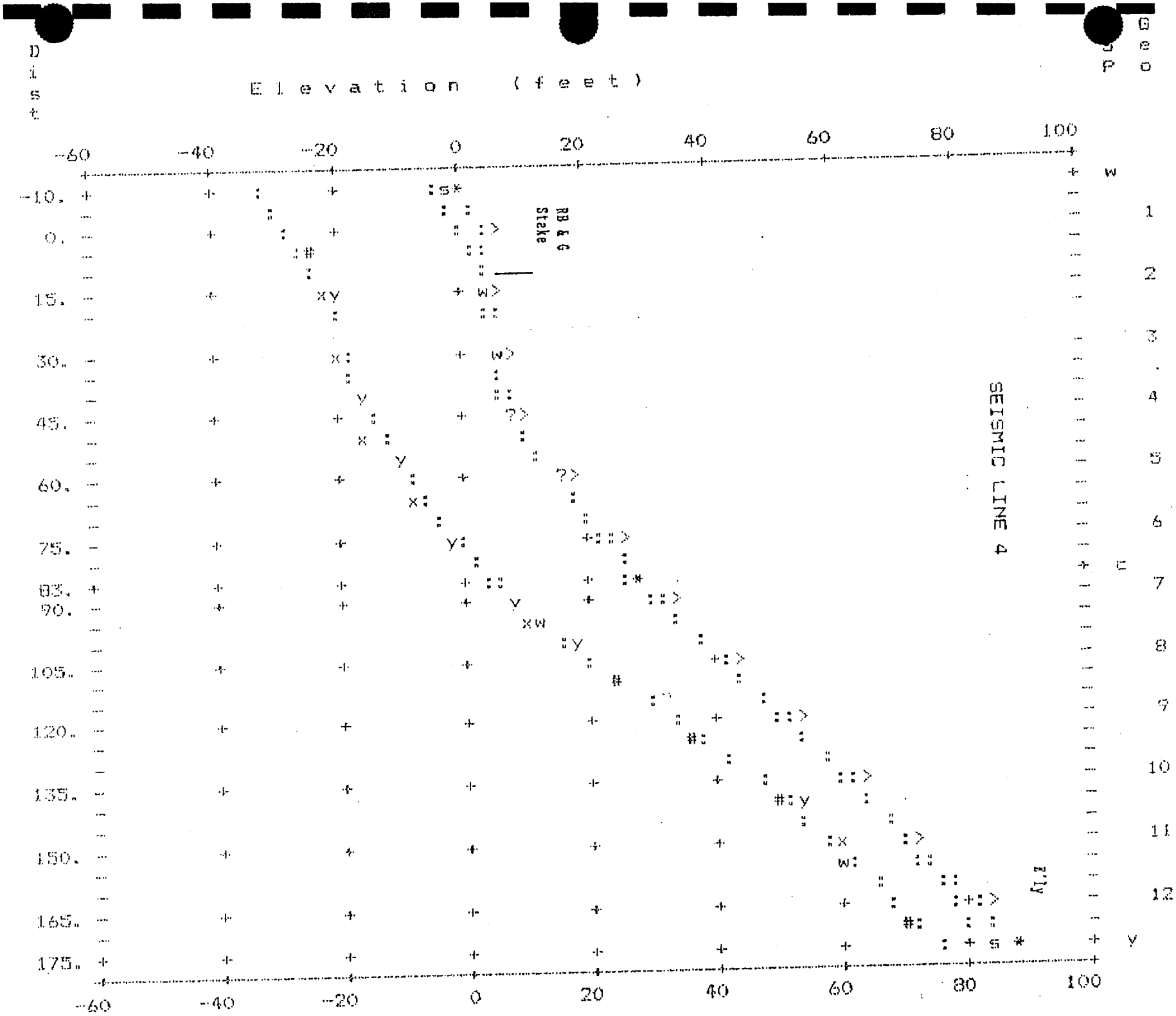
BENEATH SEISMIC LINES 1 TO 7


Dist
Elevation (feet)
SP
Geo
-80
-60
-40
-20
0
20
40
60
80
-10.
0.
15.
30.
45.
60.
75.
83.
90.
105.
120.
135.
150.
165.
W
C
E
1
2
3
4
5
6
7
8
9
10
11
12
RB & G
Stake
SEISMIC LINE 1
City

FIGURE


Dist
Elevation (feet)
Geo Sp
-100
-80
-60
-40
-20
0
20
40
60
-10.
0.
15.
30.
45.
60.
75.
83.
90.
105.
120.
135.
150.
165.
RB & G Stake
SEISMIC LINE 2
Fly

SEISMIC LINE 3
RB & G
Stake
Fly
Elevation (feet)
80
60
40
20
0
-20
-40
-60
-80
175'
165'
150'
135'
120'
105'
90'
75'
60'
45'
30'
15'
0'
-10'
1
2
3
4
5
6
7
8
9
10
11
12


Elevation (feet)
Dist
Geo
SEISMIC LINE 4
RB & G Stake
-60
-40
-20
0
20
40
60
80
100
-10.
0.
15.
30.
45.
60.
75.
83.
90.
105.
120.
135.
150.
165.
175.
1
2
3
4
5
6
7
8
9
10
11
12

FIGURE

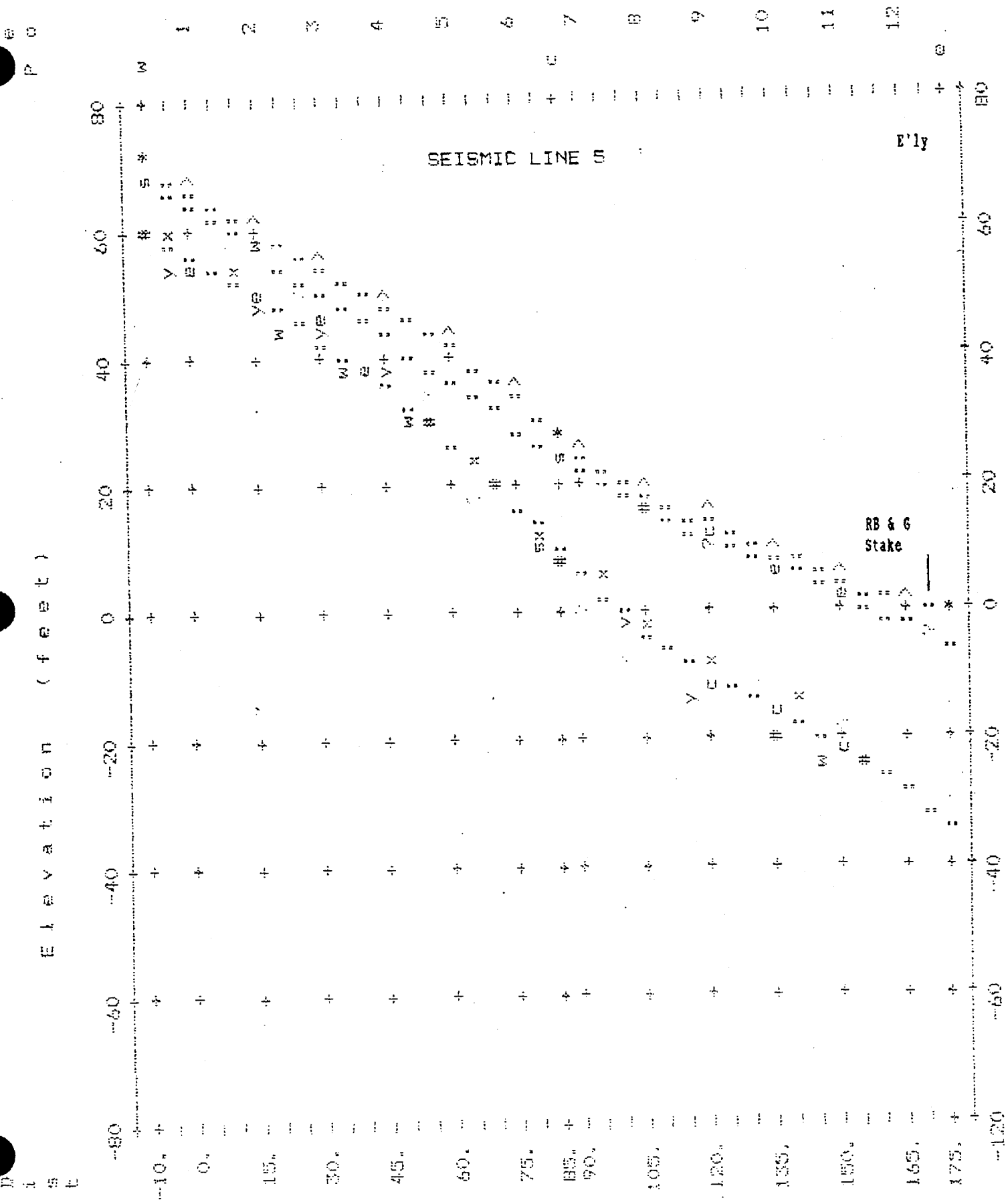
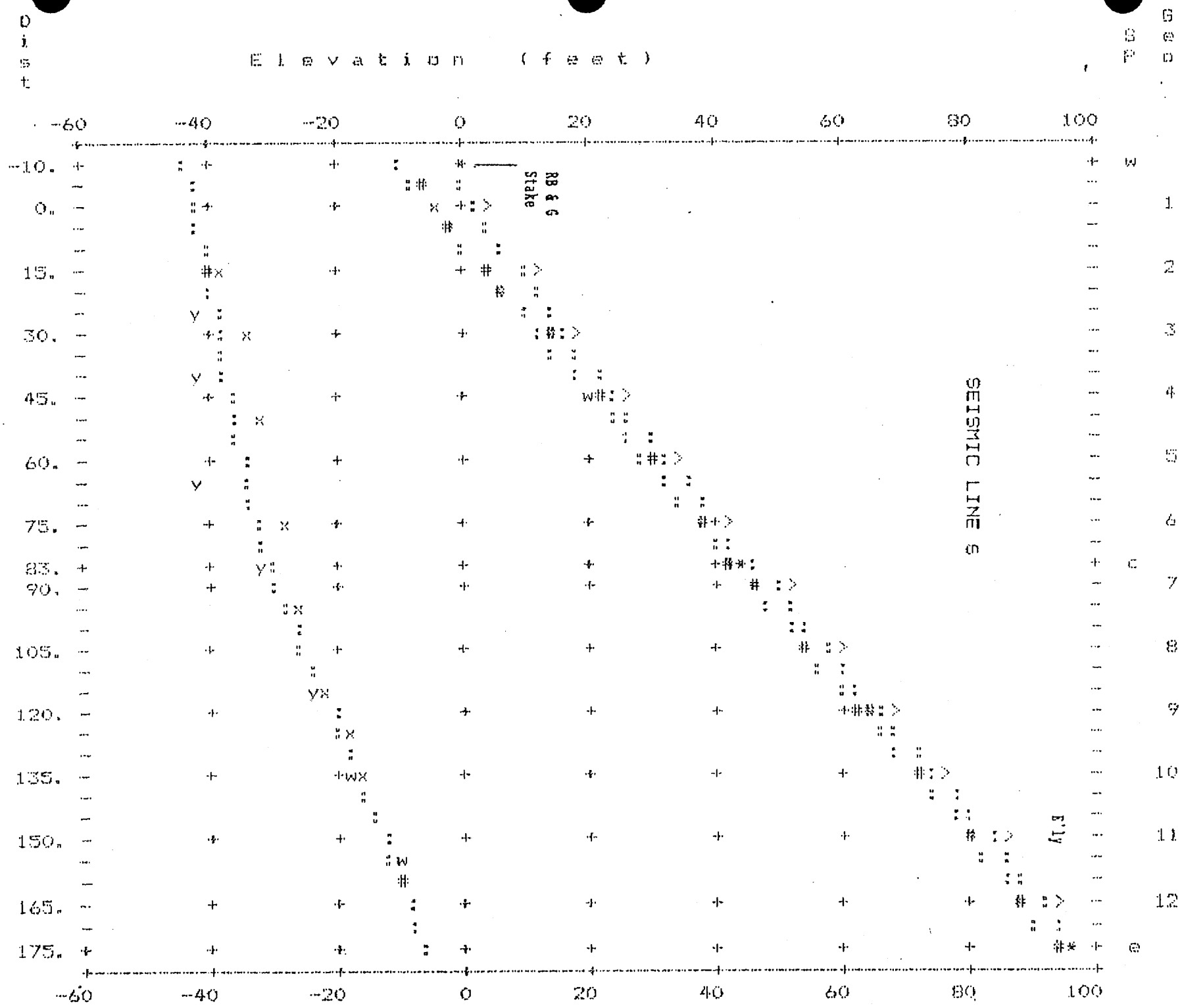


FIGURE A-


Dist
Elevation (feet)
Geo
SP
-60
-40
-20
0
20
40
60
80
100
-10.
0.
15.
30.
45.
60.
75.
83.
90.
105.
120.
135.
150.
165.
175.
1
2
3
4
5
6
7
8
9
10
11
12
RB & G
Stake
SEISMIC LINE 6
Fly

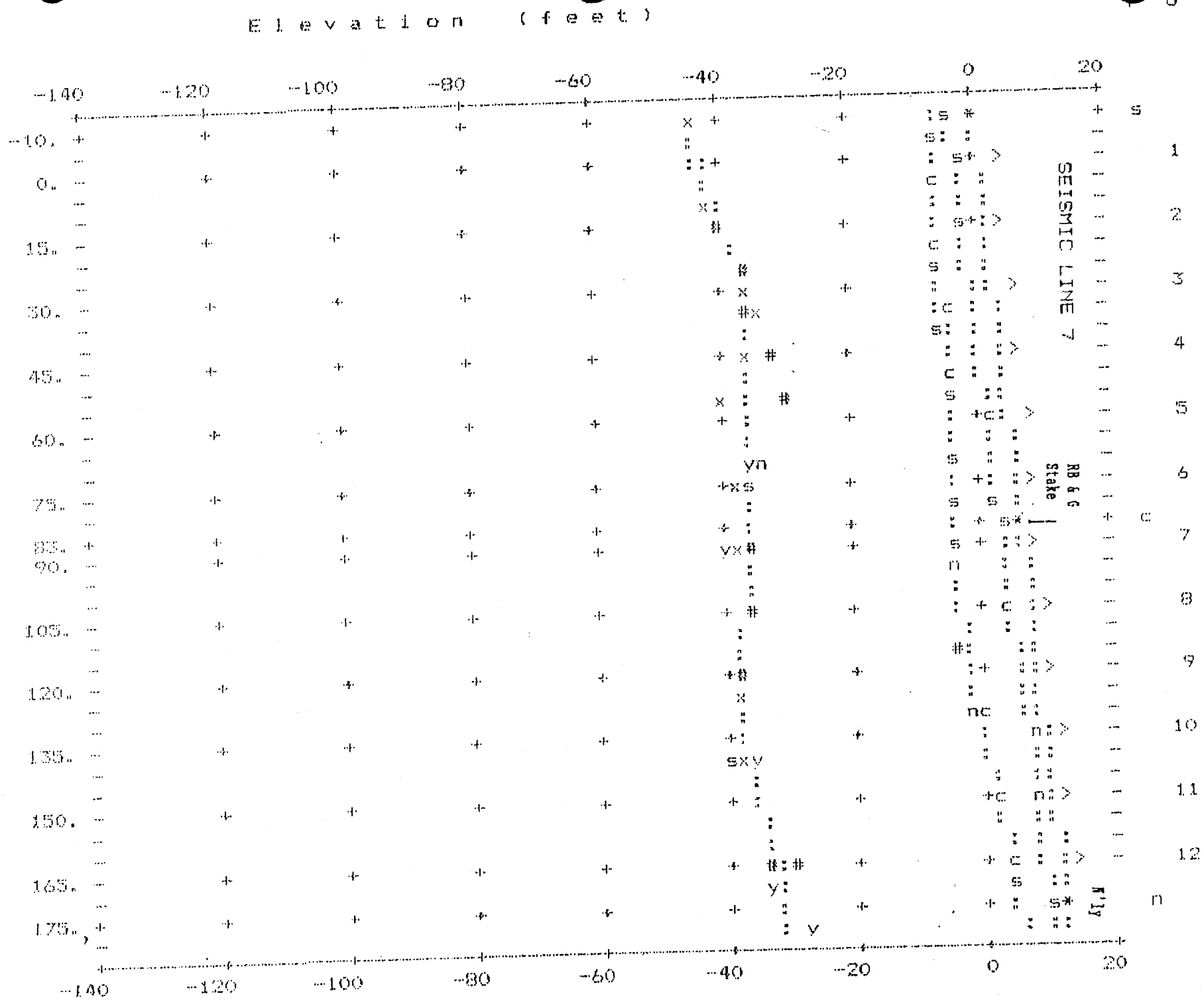

Elevation (feet)
SEISMIC LINE 7
RB & G
Stake
Fly
-140
-120
-100
-80
-60
-40
-20
0
20
-10.
0.
15.
30.
45.
60.
75.
85.
90.
105.
120.
135.
150.
165.
175.
1
2
3
4
5
6
7
8
9
10
11
12

FIGURE A-

APPENDIX B

LAYER DEPTHS AND ELEVATIONS BENEATH

GEOPHONES FOR SEISMIC LINES 1 TO 7

AND SEISMIC VELOCITIES USED

LINE 1 Depth and Elev of layers directly beneath SPs and Geos

SP	Surface X-Loc	Surface Elev	Layer 2 Depth	Layer 2 Elev	Layer 3 Depth	Layer 3 Elev
w	-10.0	.0	2.4	-2.4	32.0	-32.0
c	82.5	16.5	6.0	10.5	34.0	-17.5
e	165.0	70.0	4.0	66.0	31.2	38.8
Geo						
1	.0	2.5	3.7	-1.2	33.0	-30.5
2	15.0	3.5	2.3	1.2	34.5	-31.0
3	30.0	5.0	3.4	1.6	34.0	-29.0
4	45.0	7.5	4.4	3.1	33.4	-25.9
5	60.0	10.5	5.5	5.0	32.7	-22.2
6	75.0	14.5	6.3	8.2	34.5	-20.0
7	90.0	19.5	6.7	12.8	34.5	-15.0
8	105.0	27.5	7.0	20.5	34.8	-7.3
9	120.0	35.0	4.9	30.1	33.8	1.2
10	135.0	46.5	4.2	42.3	37.5	9.0
11	150.0	58.5	1.7	56.8	37.4	21.1
12	165.0	70.5	4.5	66.0	31.7	38.8

Velocities used, LINE 1

Layer 1	Layer 2	Layer 3
743.	2212.	7581.

LINE 2 Depth and Elev of layers directly beneath SPs and Geos

SP	Surface X-Loc	Surface Elev	Layer 2 Depth	Layer 2 Elev	Layer 3 Depth	Layer 3 Elev
w	-10.0	.0	.0	.0	37.5	-37.5
c	82.5	13.0	3.5	9.5	34.1	-21.1
e	165.0	47.0	6.1	40.9	14.2	32.8
Geo						
1	.0	4.0	1.3	2.7	39.6	-35.6
2	15.0	7.5	3.4	4.1	40.9	-33.4
3	30.0	9.5	3.9	5.6	35.1	-25.6
4	45.0	10.5	3.5	7.0	33.2	-22.7
5	60.0	11.0	3.5	7.5	34.4	-23.4
6	75.0	12.0	3.2	8.8	34.4	-22.4
7	90.0	13.5	3.4	10.1	33.3	-19.8
8	105.0	15.0	2.8	12.2	31.9	-16.9
9	120.0	17.0	2.7	14.3	29.9	-12.9
10	135.0	25.5	4.2	21.3	28.4	-2.9
11	150.0	36.5	3.7	32.8	24.0	12.5
12	165.0	47.5	6.6	40.9	14.7	32.8

Velocities used, LINE 2

Layer 1	Layer 2	Layer 3
603.	2588.	6986.

FIGURE B

LINE 3 Depth and Elev of layers directly beneath SPs and Geos

SP	Surface X-Loc	Surface Elev	Layer 2 Depth	Layer 2 Elev	Layer 3 Depth	Layer 3 Elev
w	-10.0	.0	4.2	-4.2	33.0	-33.0
c	82.5	21.0	3.0	18.0	28.2	-7.2
e	175.0	68.0	.0	68.0	31.0	37.0
Geo						
1	.0	7.0	5.0	2.0	35.6	-28.6
2	15.0	11.0	5.3	5.7	32.8	-21.8
3	30.0	14.5	4.5	10.0	32.0	-17.5
4	45.0	17.5	2.6	14.9	29.9	-12.4
5	60.0	19.5	3.2	16.3	28.0	-8.5
6	75.0	22.5	4.0	18.5	28.2	-5.7
7	90.0	26.5	3.1	23.4	28.4	-1.9
8	105.0	31.0	2.5	28.5	28.5	2.5
9	120.0	36.5	1.0	35.5	28.0	8.5
10	135.0	44.0	.5	43.5	29.0	15.0
11	150.0	51.0	.0	51.0	29.3	21.7
12	165.0	62.0	.0	62.0	30.0	32.0

Velocities used, LINE 3

Layer 1	Layer 2	Layer 3
786.	2408.	7093.

LINE 4 Depth and Elev of layers directly beneath SPs and Geos

SP	Surface X-Loc	Surface Elev	Layer 2 Depth	Layer 2 Elev	Layer 3 Depth	Layer 3 Elev
w	-10.0	.0	3.5	-3.5	31.6	-31.6
c	82.5	27.0	.0	27.0	22.8	4.2
y	175.0	88.0	4.4	83.6	11.6	76.4
Geo						
1	.0	3.5	3.0	.5	31.6	-28.1
2	15.0	4.5	.0	4.5	26.5	-22.0
3	30.0	6.0	.0	6.0	24.9	-18.9
4	45.0	7.5	.0	7.5	22.0	-14.5
5	60.0	15.5	.0	15.5	24.3	-8.8
6	75.0	23.0	.0	23.0	23.5	-.5
7	90.0	31.0	.0	31.0	22.2	8.8
8	105.0	41.5	.0	41.5	21.2	20.3
9	120.0	51.0	.0	51.0	17.6	33.4
10	135.0	61.0	.0	61.0	13.3	47.7
11	150.0	70.5	.3	70.2	11.9	58.6
12	165.0	81.0	2.8	78.2	12.8	68.2

Velocities used, LINE 4

Layer 1	Layer 2	Layer 3
878.	1923.	6386.

FIGURE B-2

LINE 5 Depth and Elev of layers directly beneath SPs and Geos

	Surface		Layer 2		Layer 3	
SP	X-Loc	Elev	Depth	Elev	Depth	Elev
---	---	---	---	---	---	---
w	-10.0	71.0	2.5	68.5	10.8	60.2
c	85.0	28.0	3.8	24.2	18.5	9.5
e	175.0	.0	6.0	-6.0	33.4	-33.4
Geo						

1	.0	65.5	1.7	63.8	10.4	55.1
2	15.0	59.5	2.3	57.2	9.4	50.1
3	30.0	54.5	4.4	50.1	11.5	43.0
4	45.0	48.5	5.5	43.0	13.0	35.5
5	60.0	41.5	5.5	36.0	14.6	26.9
6	75.0	33.5	4.6	28.9	16.5	17.0
7	90.0	24.5	2.7	21.8	18.8	5.7
8	105.0	18.0	2.2	15.8	21.8	-3.8
9	120.0	13.0	2.0	11.0	24.1	-11.1
10	135.0	8.5	1.9	6.6	24.5	-16.0
11	150.0	4.5	2.1	2.4	25.9	-21.4
12	165.0	-.5	2.3	-2.8	28.5	-29.0

Velocities used, LINE 5

Layer 1	Layer 2	Layer 3
---	---	---
728.	2095.	6517.

LINE 6 Depth and Elev of layers directly beneath SPs and Geos

	Surface		Layer 2		Layer 3	
SP	X-Loc	Elev	Depth	Elev	Depth	Elev
---	---	---	---	---	---	---
w	-10.0	.0	10.1	-10.1	43.4	-43.4
c	83.0	44.0	2.1	41.9	75.1	-31.1
e	175.0	95.0	1.5	93.5	100.7	-5.7
Geo						

1	.0	1.5	6.0	-4.5	43.7	-42.2
2	15.0	9.5	5.8	3.7	49.6	-40.1
3	30.0	15.5	3.2	12.3	53.9	-38.4
4	45.0	24.0	3.8	20.2	60.6	-36.6
5	60.0	32.5	3.7	28.8	67.0	-34.5
6	75.0	40.5	3.3	37.2	73.4	-32.9
7	90.0	49.0	3.0	46.0	78.6	-29.6
8	105.0	57.0	3.5	53.5	82.2	-25.2
9	120.0	65.5	3.0	62.5	86.4	-20.9
10	135.0	74.0	2.7	71.3	90.6	-16.6
11	150.0	83.0	3.0	80.0	95.4	-12.4
12	165.0	91.0	3.1	87.9	99.5	-8.5

Velocities used, LINE 6

Layer 1	Layer 2	Layer 3
---	---	---
712.	2822.	9160.

FIGURE B-3

LINE 7 Depth and Elev of layers directly beneath SPs and Geos

	Surface		Layer 2		Layer 3		Layer 4	
SP	X-Loc	Elev	Depth	Elev	Depth	Elev	Depth	Elev
s	-10.0	-.5	2.8	-3.3	5.9	-6.4	43.1	-43.6
c	82.5	6.5	3.5	3.0	10.3	-3.8	43.2	-36.7
n	175.0	12.0	2.4	9.6	7.3	4.7	43.3	-31.3
Geo								
1	.0	1.0	3.6	-2.6	7.1	-6.1	43.8	-42.8
2	15.0	2.0	3.8	-1.8	7.7	-5.7	41.3	-39.3
3	30.0	3.0	3.6	-.6	8.3	-5.3	38.3	-35.3
4	45.0	4.0	3.5	.5	8.4	-4.4	39.2	-35.2
5	60.0	5.0	3.4	1.6	9.0	-4.0	41.2	-36.2
6	75.0	6.0	3.5	2.5	9.9	-3.9	42.6	-36.6
7	90.0	6.8	3.3	3.5	10.5	-3.7	43.7	-36.9
8	105.0	7.6	3.1	4.5	10.8	-3.2	44.5	-36.9
9	120.0	8.4	2.6	5.8	10.5	-2.1	46.1	-37.7
10	135.0	9.2	2.1	7.1	9.2	.0	47.6	-38.4
11	150.0	10.0	2.1	7.9	7.8	2.2	45.6	-35.6
12	165.0	11.8	2.9	8.9	8.2	3.6	43.7	-31.9

Velocities used, LINE 7

Layer 1	Layer 2	Layer 3	Layer 4
588.	1567.	2687.	7992.

REPORT

GEOTECHNICAL EVALUATION AND DESIGN SERVICES

RILDA CANYON PROJECT

LOCATED NEAR HUNTINGTON, UTAH

FOR ENERGY WEST MINING COMPANY

Prepared for:

Energy West Mining Company

P.O. Box 310

Huntington, Utah 84528

GDS Job No. 001-95-02
Oct. 16, 1995

GEOTECHNICAL DESIGN SERVICES, INC.

GEOTECHNICAL DESIGN SERVICES, Inc.
9462 South Tanya Avenue
South Jordan, Utah 84095
(801)253-4889 phone/fax

October 16, 1995
GDS Job No. 001-95-02

Energy West Mining Company
P.O. Box 310
Huntington, Utah 84528

Attention: Mr. John Christensen

Gentlemen:

Re: Report
Geotechnical Evaluation and Design Studies
Rilda Canyon Project
Located near the Huntington Power Plant
for Energy West Mining Company

This letter transmits four (4) copies of the final report presenting results of geotechnical evaluation and design studies conducted for the above referenced project . This report includes discussions concerning subsurface conditions at the site, the status of the previously mapped landslide on the north side of the canyon, detailed foundation, earthwork, other geotechnical recommendations, and the completed Welded Wire Wall designs.

If you should have any questions concerning this report, please do not hesitate to call.

Respectfully Submitted,
GEOTECHNICAL DESIGN SERVICES, Inc.

Jerold A Bishop
Professional Engineer No. 6608
State of Utah

JAB/jb

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EXECUTIVE SUMMARY

This report presents the results of geotechnical evaluation and design studies performed for the Rilda Canyon project, presently under construction by Energy West Mining Company. The purpose of this project is to provide additional support facilities for the Deer Creek Mine. These studies were performed to provide pertinent geotechnical design data for the project.

As requested, this study consisted of field investigations for both geotechnical and engineering geology data. Laboratory tests were performed on samples of soil taken in the field. Engineering and geologic analyses were then performed to determine the necessary conclusions for the discussions presented in this report. Finally, the design of a series of Welded Wire Wall reinforced soil retaining walls for support of the access road, the stream crossing and the downhill side of the main facilities pad was prepared (and previously submitted under separate cover).

The results of these studies indicate the site is suitable for the intended development. The landslide identified and mapped in previous investigations of the site area was determined to be ancient and dormant, with little likelihood of reactivation under the present circumstances. The stability of the planned cut slopes was determined to be adequate, provided that positive erosion control measures are taken. The suitability of the canyon bottom for support of the near vertical reinforced soil retaining walls was determined to be adequate. Finally, it was determined that the on-site soils may be used as fill material in the project construction.

The designs of the several reinforced soil retaining walls has been completed. Full size (size D) drawings were previously submitted to facilitate project scheduling. A set of these drawings are appended to this report, together with a design memorandum detailing the calculations required for the wall designs.

Detailed discussions for each of the above mentioned points are presented in the following pages.

1. INTRODUCTION

1.1. GENERAL

This report presents the results of geotechnical evaluation and design studies performed at the site of the proposed Rilda Canyon development located near Huntington, Utah. The general location of the site with respect to major topographic features, adjacent roads, and other man-made facilities is presented on Figure 1, Vicinity Map. A more detailed layout of the site showing the overall area to be developed with the access roadway and stream crossings is presented on Figure 2, Site Plan. The locations of the 3 borings drilled in conjunction with this project are also presented on Figure 2.

1.2. OBJECTIVES AND SCOPE

The objectives and scope of this investigation were planned in discussions between Mr. Jerold Bishop of Geotechnical Design Services, Mr. John Christensen of Energy West Mining, and Mr. Harold Hilfiker of the Hilfiker Retaining Wall Company. The general objectives of this investigation were to provide earthwork, slope stability and foundation recommendations to be utilized in the design and construction of the proposed facilities, as well as to provide completed designs for the reinforced soil (Welded Wire Wall) retaining walls. In accomplishing the above objectives, the scope of this project has included the following:

1. A field program consisting of a site visit and drilling, logging, and sampling of 3 borings to depths varying from 6.5 to 38.1 feet below existing grade.

2. A laboratory testing program.

3. An office program consisting of the correlation of available data, engineering analyses, and the preparation of this summary report.

4. Preparation of design plans for the construction of a series of Welded Wire Wall segments along the road and stream crossing alignment as well as to support the main facilities pad.

1.3. AUTHORIZATION

Authorization to proceed with this investigation was provided by Energy West Mining in Contract No. JD T-98 to Hilfiker Retaining Walls, which included authorization to perform these studies.

1.4. PROFESSIONAL STATEMENTS

Supporting data upon which these recommendations and retaining wall designs are based are presented in subsequent sections of this report. Recommendations presented herein are governed by the physical properties of the soils encountered in the exploration borings, projected groundwater conditions, and the layout and design data discussed in Section 2, Proposed Construction, of this report. If subsurface conditions other than those described in this report are encountered and/or if design and layout changes are implemented, Geotechnical Design Services Inc. must be informed so that these recommendations and designs can be reviewed, as necessary.

2. PROPOSED CONSTRUCTION

The Rilda Canyon Project involves construction of surface facilities at a heretofore undeveloped site in Rilda Canyon for additional support to the existing Deer Creek Mine, near the Huntington Power Plant in Emery County, Utah. The mine will be extended into this area and serviced at the site by a fan house, water tank, pump house, power substation and two portals.

The site development plan for this project includes the construction of an access road and a main facilities pad for the plant facilities. The access road will be about a quarter mile long and will involve significant improvements of the original rough cut road that has been present along this alignment for several years. At the end of this road, a level pad for the project construction will be built to the rough dimensions of 150 feet by 260 feet. In order to construct this pad in the canyon bottom, grade transitions up to 20 feet high will be required, due to the relatively uneven terrain at the site. In order to construct the largest possible pad in the limited area (as defined by a "limit of disturbance") reinforced soil retaining walls will used to construct economical near vertical retaining walls to allow construction up to the edge of the designated zone.

As part of the site development, existing slopes will be cut back to accommodate the proposed construction and subsequent operations. Following the reclamation of the project, these slopes will be flattened. The maximum cut slopes for the construction/operation phase is planned to be 1.5 horizontal to 1.0 vertical. Reclaimed slopes are planned to be no steeper than 2.9 horizontal to 1.0 vertical.

Previous geotechnical investigations of the site have been limited to exploration borings drilled nearly five hundred feet away. This study also included three seismic refraction surveys across the actual pad location. In this investigation, relatively deep alluvial deposits were identified in the canyon bottom. Also, this investigation identified a landslide deposit on the north side of the canyon, at the location where the planned access road turns south into the main pad area supporting the proposed main facilities.

3. INVESTIGATIONS

3.1. SUBSURFACE EXPLORATION

The subsurface soil and groundwater conditions at the site were explored by drilling three borings to depths ranging from 6.5 to 38.1 feet below existing ground surface. These borings were drilled using an all terrain mounted rotary drill rig (CME-750). The locations of these borings are referenced on Figure 2.

At the site of Boring B-1, several attempts were made to drill to the planned depth of 25.0 feet. Drilling refusal was encountered on each attempt, whereupon the boring location was moved several feet in an attempt to find a location which the drill could penetrate the near-surface cobbles and boulders encountered. This was not possible in this general area, resulting in a maximum depth of penetration of only 6.5 feet. At Boring B-3, drilling refusal was also encountered, at a depth of 38.1 feet. The planned depth for this boring was 45 feet, however, no offset borings were performed because the original boring was relatively close to this depth.

The field program was supervised by an experienced geotechnical field engineer who maintained a continuous log of the subsurface conditions encountered. The soils were classified by visual and textural examination in the field. These classifications were later reviewed by subsequent re-examination of the soil samples in the laboratory. Detailed graphical representations of the subsurface conditions encountered are presented on Figure 3, Log of Borings. The soils were classified in accordance with the nomenclature described on Figure 4, Unified Soil Classification System.

3.2. LABORATORY TESTING

3.2.1. General

A laboratory testing program was conducted to provide data for our engineering analyses. The program included moisture, density, and sieve analysis tests. The following sections describe the tests and summarize the test data.

3.2.2. Moisture and Density Tests

To aid in classifying the soils and to help correlate other test data, moisture and density tests were performed on selected undisturbed samples. The results of the moisture and density tests are presented to the left of the boring logs on Figures 3A through 3B.

3.2.3. Gradation Tests

To aid in classifying the soils, gradation tests were performed on selected samples of near surface soils. This included determination of the full range of gradation as well as just the percentage

of soil passing the No. 200 sieve (for selected samples deeper in the soil profile). Results of the gradation tests are tabulated below:

Boring or Test Pit No.	Depth (feet)	Percent Passing by Weight								Soil Classification
		3/4"	3/8"	No.4	No.10	No.20	No.40	No.100	No.200	
B-1	0 to 5	93	91	89	86	82	75	50	35	SM
B-2	0 to 5	97	92	87	83	81	74	36	24	SM
B-2	10	—	—	—	—	—	—	—	30	SM/GM
B-2	15	—	—	—	—	—	—	—	6	GP/GM
B-3	0 to 4	100	99	98	98	97	93	51	36	SM

4. SITE CONDITIONS

4.1. SURFACE CONDITIONS

The general location of the site is in the left hand fork of Rilda Canyon. Rilda Canyon is located about 4 miles northwest of the Huntington Power Plant, approximately 10 miles northwest of Huntington, Utah.

The Canyon in the area of the project is relatively steep sided and narrow, with extensive vegetation consisting of both trees and brush present on the canyon bottom and the north facing slopes. There are no man-made facilities of note in the general area. The unimproved access road is narrow and winding, suitable only for small four wheel drive vehicles. The stream bed is steep sided and carries a widely varying flow of water from the upper canyon to the south.

At the present time, operations are underway to clear the pad area and build the pad to the required elevation, together with the Welded Wire Wall retaining wall systems which will support portions of the improved access road, stream crossing and the main facilities pad.

4.2. SUBSURFACE CONDITIONS

The soil conditions encountered at the site were relatively uniform at the locations of the three borings drilled for this study. In general, a silty sand soil, having some gravel was encountered in each of the borings, at the surface. This loose to medium dense soil continued to a depth of four to five feet, where the soil generally became more gravelly with depth. Silty sands and gravels dominated the soil profile, with occasional cobbles and boulders being encountered. A layer of clayey gravels was encountered in Boring B-3, at a depth of 30 feet. The consistency of these sandy and gravelly soils typically ranged from medium dense to very dense, with most

of the samples taken demonstrating a dense consistency. In general, these granular soil exhibit high strength and low compressibility characteristics.

Figure 3, Log of Borings, presents a graphical representation of the soils encountered at each of the boring locations. The lines designating the interface between soil types on the boring logs generally represent approximate boundaries. In-situ, the transition between soil types may be gradual.

Groundwater was encountered during drilling operations in Borings B-2 and B-3, at depths of 28'-10" and 34'-1", respectively. No provisions were made for further monitoring of groundwater levels.

Fluctuations in groundwater levels can occur due to variations in precipitation, runoff, local irrigation, water levels in nearby ditches, runoff channels and drainages, and other factors. Seasonal and longer-term groundwater fluctuations on the order of four to five feet should be anticipated. The highest seasonal levels could occur during the late spring and summer months.

5. DISCUSSIONS AND RECOMMENDATIONS

5.1. DISCUSSIONS OF FINDINGS

The results of this investigation indicate that the site is adequate for the proposed development. The existing at-grade soils are adequate for support of the reinforced soil retaining walls presently planned for the site development. The pad as planned will support the proposed facilities using conventional shallow foundations.

A review of the landslide mass located along the northern edge of the access road indicates that it is an ancient slide mass and is presently dormant. It is not considered likely that the proposed site development will affect the status of this slide mass, therefore, it is expected that further movement by this slide is unlikely.

Utilization of the on site materials for the proposed pad construction is considered feasible. The on-site soils are generally granular in nature and will demonstrate reasonably good compaction characteristics. Because these soils are generally without any plastic fines (typically known as "binder"), it is expected that they will be somewhat "mobile" during the compaction process. This means that it may be difficult to achieve high in-place densities during placement operations. Construction of slopes will be difficult and that the compacted surface will be easily

disturbed. Foundations for settlement sensitive facilities should be placed upon a two foot to three foot thick pad of well-graded, high density, road base quality structural fill extending to the fill constructed of the on-site soils.

It is essential that all existing fill, vegetation, loose or disturbed surficial soils, or otherwise unsuitable near-surface soils be completely removed from all pad areas. Foundations may be established upon properly prepared existing near-surface soils or suitable undisturbed natural soils, and/or upon structural fill extending to properly prepared existing near-surface soils, or suitable undisturbed natural soils.

The site is suitable for utilization of the Welded Wire Wall system to support the road, river crossing and main facilities pad. Foundation stability will be adequate with the near surface bedrock along the north side of the valley and the high strength foundation soils present beneath the main facilities pad.

A review of the proposed site grading indicates that cut slopes for the construction of the proposed facilities as well as final grade for the reclaimed site will have an adequate factor of safety against slope instability.

Detailed discussions pertaining to slope stability, earthwork, foundations, and the retaining wall design criteria are presented in the following sections.

5.2. LANDSLIDE EVALUATION

The area investigated is located on the north slope of the Left Fork of Rilda Canyon, across from the proposed Rilda Canyon Mine facilities. The portion of the hillslope suspected of being a landslide is delineated as a Quaternary Landslide in previous reports of the site. The slide mass is described as a lobe of a debris flow channelized between two separated sandstone cliffs.

Field observations by Great Basin Earth Science verified that the outcrop of sandstone is discontinuous across the hillside. In the area between outcrops there is no in-place bedrock exposed at the surface. The material consists of colluvial soils and blocks of transported bedrock, suggesting landslide movement. The displaced colluvial material appears to cut through the sandstone cliffs rather than cover them up. This topographic relation and the lobate morphology of the material further suggests landslide and/or debris flow movement.

Observations of the interior of the landslide upslope from the sandstone cliffs indicate only a few isolated sections of bedrock that appear in place. There were no distinct boundaries on the flanks of the landslide to delineate the areas that had moved from those that had not. Furthermore,

there was no clear evidence observed in the field of a head scarp at the top of the landslide.

Examination of the Rilda Canyon, Utah 7.5 minute topographic map indicates that there is no topographic expression of the landslide at the 1:24000 scale. Furthermore, mapping by others at a scale of 1:1800, shows no topographic expression indicating the presence of a landslide. However, examination of stereo pairs of vertical aerial photographs at scales of 1:20000 and 1:40000 both clearly show the lobate shape of the toe of the landslide. The exposure on the photographs is not sharp enough to delineate the head scarp or flanks of the landslide.

None of the previous studies that have mapped landslides on a regional scale in Utah have shown a landslide at this location; however, this may be simply a function of the small size of this feature.

Based upon the previous observations and mapping, the geomorphic features observed in the field and the recognitions of landslide features on the aerial photographs, it is concluded that this is a landslide. However, because of the lack of distinct features at the flanks and head of the slide mass, the certainty of identification is delineated as probable. Based upon the morphology and vegetation of the landslide, it is classified as an inactive, mature or dormant slide. Because of the age and apparent inactive nature of the slidemass, the risk of reactivation is judged to be low.

5.3. EARTHWORK

5.3.1. Site Preparation

Preparation of the site for construction should include the removal of all surface vegetation, topsoil, debris, existing non-engineered fill, and any other deleterious materials from all proposed development areas. It is estimated that approximately three to four inches of stripping will be necessary to remove vegetation and major roots and organics in most areas of the site. The stripped materials will be unsuitable for use as structural fill, but may be stockpiled for subsequent landscaping purposes, if desired.

Subsequent to stripping and removal of all organics and vegetation from all areas to be structurally loaded, and removal of the disturbed surficial soils from all construction areas, the remaining exposed subgrade soils should be proofrolled and compacted. Proofrolling and compaction may be accomplished by passing moderately loaded rubber tire-mounted construction equipment over the surface at least twice. If excessively soft or loose areas are encountered during proofrolling, they must be completely removed to a maximum depth of two feet and be replaced with structural fill. Following the above operations, site development may continue and structural site grading fill may be placed.

In removing trees from areas to be structurally loaded, the entire root bulb must be removed and replaced with structural fill.

5.3.2. Fill Material

Structural fill is defined as all fill material which will be used for pad or road construction, fill utilized to construct Welded Wire Walls, and fill which will ultimately be subjected to structural loadings such as imposed by footings, floor slabs, etc. It is recommended that all structural fill be free of sod, rubbish, topsoil, frozen soil, and any other deleterious materials. On site non-organic soils will be suitable for this application, as well as most other non-organic granular soils.

For structural site grading fill, the maximum particle size should generally not exceed four inches. However, it should be noted that occasional larger particles not exceeding eight inches in diameter may be incorporated provided that they do not result in "honeycombing" or preclude the obtainment of the desired degree of compaction. The maximum particle size within structural fill placed within confined areas should generally be restricted to two inches. In open areas, where structural site grading fill will be placed, suitable fine-grained soils (silts and clays) may be utilized. It should be noted, however, that proper compaction of the fine-grained soils will require that close moisture control be maintained during placement and compaction. This will be very difficult, if not impossible, during wet and cold weather. Utilization of granular soils for all structural fill will expedite fill placement and compaction operations. Silty and clayey soils are not very well suited for utilization as structural fill.

Non-structural site grading fill is defined as all fill material not designated as structural fill and may consist of any cohesive or granular soil not containing excessive amounts of degradable material.

5.3.3. Fill Placement and Compaction

Structural fill should be placed in lifts not exceeding 8 inches in loose thickness and compacted using self propelled compaction equipment. Structural fill used for pad construction should be compacted to a minimum of 90 percent of the maximum dry density as determined by the AASHTO[1] T-180 (ASTM[2] D-1557) method of compaction. In areas where structural fill will be in excess of six to seven feet in thickness, the fill compaction should be a minimum of 95

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[1]American Association of State Highway and Transportation Officials

[2]American Society for Testing and Materials

percent of the above criteria. At locations where building or equipment foundations will be placed, fill material directly supporting these foundations should be compacted to a minimum of 95 percent of the maximum dry density, to a minimum of three feet below footing grade. If the on-site soils are too mobile during compaction to easily achieve this level of compaction, this upper three feet can be made of a well graded road base material, compacted to a minimum of 95 percent of the maximum dry density.

Subsequent to stripping and prior to the placement of structural site grading fill, the subgrade should be prepared as discussed in Section 5,2.1., Site Preparation. In confined areas, subgrade preparation should consist of the removal of all loose, unsuitable, and disturbed soils.

Non-structural fill may be placed in lifts not exceeding 12 inches in loose thickness and compacted by passing construction, spreading, or hauling equipment over the surface at least twice.

5.4. SLOPE STABILITY

A review of the proposed cut slopes was made to determine the adequacy of these slopes for their intended application and an estimate of their long-term performance. As noted earlier, cut slopes for the operating condition will be no steeper than 1.5 horizontal to 1.0 vertical, while final reclaimed slopes will be no steeper than 2.9 horizontal to 1.0 vertical.

A stability analysis was performed to evaluate the factor of safety against slope instability for the operating slopes. Because of the dramatically shallower slopes involved in the final reclaimed condition, it is apparent that the operating slopes represent the worst case. Provided that an adequate factor of safety exists with these slopes, no further analysis is necessary.

The 1.5 horizontal to 1.0 vertical slope was analyzed using software designed for evaluation of slope stability based upon established methodology. The program used was PC Stable 5M, and the methodology applied was the Janbu method of slices.

The slopes to be cut consist of colluvial materials with relatively shallow depths to bedrock throughout the area. A range of bedrock depths was considered, from 10 feet to 40 feet below existing grade. The analysis results demonstrated that the depth of the bedrock had little or no effect on the resulting factor of safety, indicating that the failure mode is the classic "infinite slope" failure.

Soil parameters applied consisted of 32 degrees for the internal angle of friction, no cohesion (in spite of the readily apparent interlocking effect that such soils typically have) and unit weight of

130 pounds per cubic feet. The underlying bedrock was considered to have substantially greater strength, forcing the analysis to consider the soil only, with the above noted results. No groundwater was applied to this problem, as the permanent groundwater table is at considerable depth with respect to the planned cut slopes.

The results of this analysis indicate that a minimum factor of safety against slope failure of 3.6 is present for the 1.5 horizontal to 1.0 slope. This is for the long-term, steady state condition. A pseudo-static coefficient of 0.15 was also applied to the problem, to simulate a large magnitude earthquake. The resulting factor of safety was 1.9. These factors of safety compare favorably with the commonly accepted minimum factors of safety for long-term and pseudo-static cases of 1.3 and 1.1, respectively. Based upon this comparison, further analysis was considered unnecessary.

A primary contributor to the long term performance of steep cut slopes is there ability to resist erosion and maintain the intended grade. In general, slopes steeper than 2.5 horizontal to 1.0 vertical (particularly when such slopes are cut into cohesionless, granular soils, as are typical of this site) require erosion control measures to maintain surface stability. Positive site drainage (where possible) away from the top of the slope and planting the surface will be necessary to maintain long term surface stability of all cut slopes.

5.5. FOUNDATIONS

5.5.1. Design Criteria

Analysis results indicate that the structures for the proposed facilities may be supported upon the pad constructed of structural fill as planned or upon suitable natural soils. It is essential that footings not be established upon loose or disturbed soils, or on improperly placed and/or compacted fill soils. All footings exposed to the full effects of frost should be established at a minimum depth of two and one-half feet below lowest adjacent final grade.

Interior footings, that is, footings in heated areas protected from the full effects of frost, may be established at higher elevations, although a minimum depth of embedment of 15 inches is recommended for confinement purposes. Floor slabs may be considered equivalent to soil in determining the depth of embedment. The minimum recommended footing width is 18 inches for continuous wall footings, and 24 inches for isolated column footings.

Spread and continuous wall footings established as recommended above may be proportioned utilizing a maximum net bearing pressure of 2,500 pounds per square foot for real (dead plus reduced live) load conditions. As discussed earlier, equipment which is settlement sensitive

should be established upon a pad of granular base course material compacted to a minimum of 95 percent of the maximum dry density, having a minimum thickness of three feet. Such foundations may also be proportioned utilizing a maximum net bearing pressure of 2,500 pounds per square foot. In either case, footings having a minimum dimension of 4 feet may be proportioned using a maximum net bearing pressure of 3,500 pounds per square feet. Bearing pressures for footings with minimum dimensions between these values may be interpolated on a straight line basis. The term "net bearing pressure" refers to that pressure imposed by the portion of the structure located above lowest adjacent final grade. Therefore, the weight of the footing and the backfill up to lowest adjacent grade may be neglected. For total load conditions, the bearing pressure may be increased by 50 percent.

5.5.2. Installation

If the natural silt and clay soils upon which the footings are to be established are soft or become loose or disturbed, they should be removed and replaced with granular structural fill. If the natural sand soils, or the granular structural fill upon which the footings are to be established become disturbed, they should be recompacted to the requirements for structural fill, or be removed and replaced with structural fill.

Under no circumstances should the footings be installed upon loose or disturbed soils, construction debris, frozen soils, existing non-engineered fill, or within ponded water.

The width of structural replacement granular fill below footings, should be extended laterally at least six inches beyond the edges of the footings in all directions for each foot of fill thickness beneath the footings. For example, if the width of the footing is two feet, and the thickness of the structural fill beneath the footing is one foot, the width of the structural fill at the base of the footing excavation would be a total of three feet.

5.5.3. Settlements

Maximum settlements of foundations designed and installed in accordance with the recommendations presented herein, and supporting the facilities discussed in Section 2, Proposed Construction, are anticipated to be on the order of one-half to five-eighths of an inch. These settlements are within tolerable limits for the type of construction proposed. Approximately 70 percent of the quoted settlements should occur during construction.

5.5.4. Lateral Resistance

Lateral loads imposed upon foundations due to wind or seismic forces may be resisted by the development of passive earth pressures and friction between the base of the footings and the supporting soils. In determining frictional resistance, a coefficient of friction of 0.40 should be utilized. Passive resistance provided by properly placed and compacted granular structural fill above the water table may be considered equivalent to a fluid with a density of 300 pounds per cubic foot. A combination of passive earth resistance and friction may be utilized provided that the friction value is divided by 2.0.

5.6. WELDED WIRE WALL DESIGN

In conjunction with this project, a complete set of design drawings was prepared for the Welded Wire Wall segments required to construct the project. The calculations required for this design are presented in a narrative form in Appendix A, Design Memorandum. A complete set of half-size drawings (11" X 17") for the project are presented in Appendix B, Design Drawings.

oOo

I appreciate the opportunity of providing this service for you. If you have any questions or require additional information, please do not hesitate to call.

Respectfully submitted,
Geotechnical Design Services, Inc.

Jerold A. Bishop, State of Utah No. 6608
Professional Engineer

Copies: (4) Addressee
(1) Hilfiker Retaining Wall Company

Energy West Mining Company
GDS Job No. 001-95-02

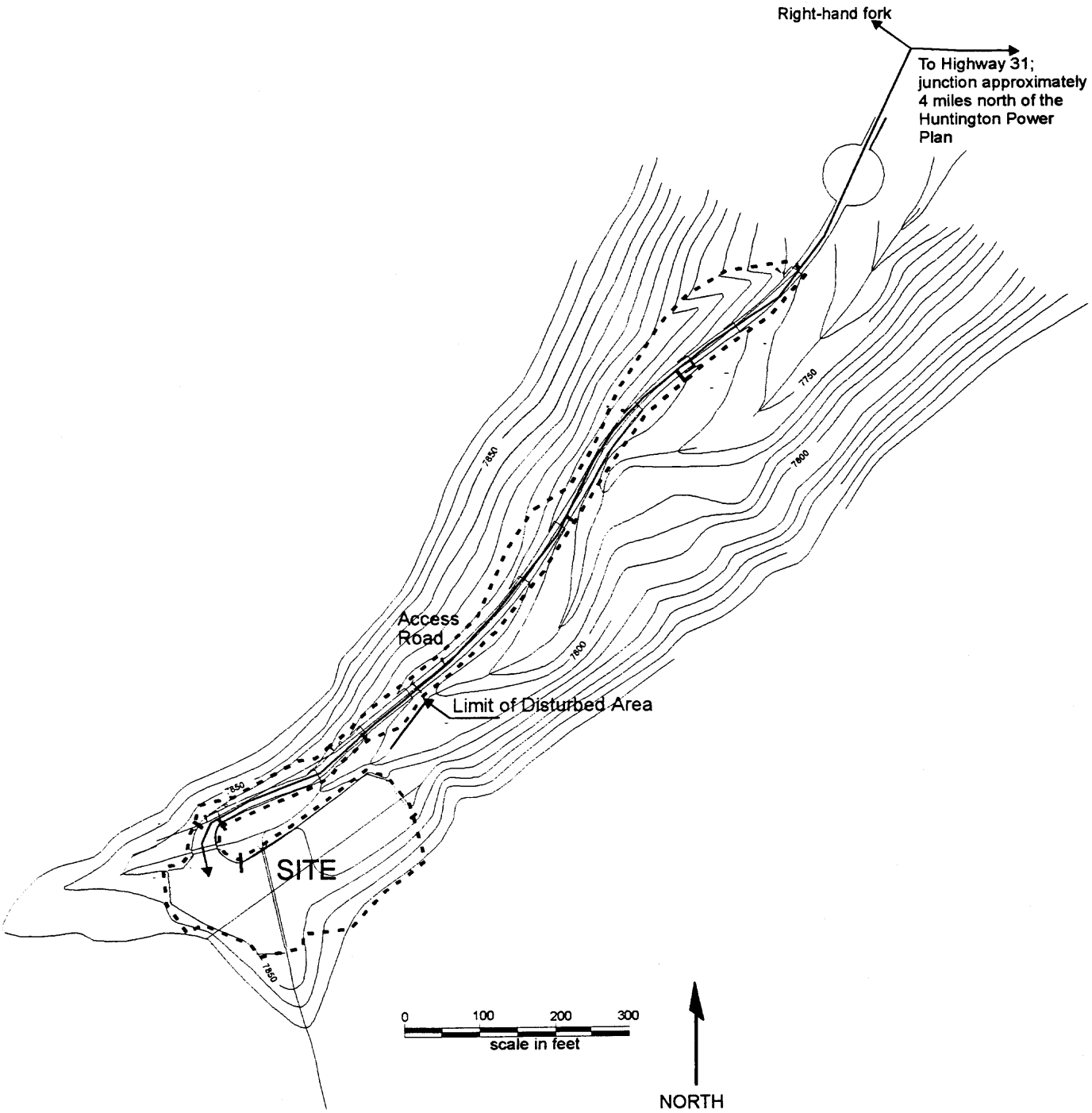


FIGURE 1 - VICINITY MAP

GEOTECHNICAL DESIGN SERVICES INC.

Energy West Mining Company
GDS Job No. 001-95-02

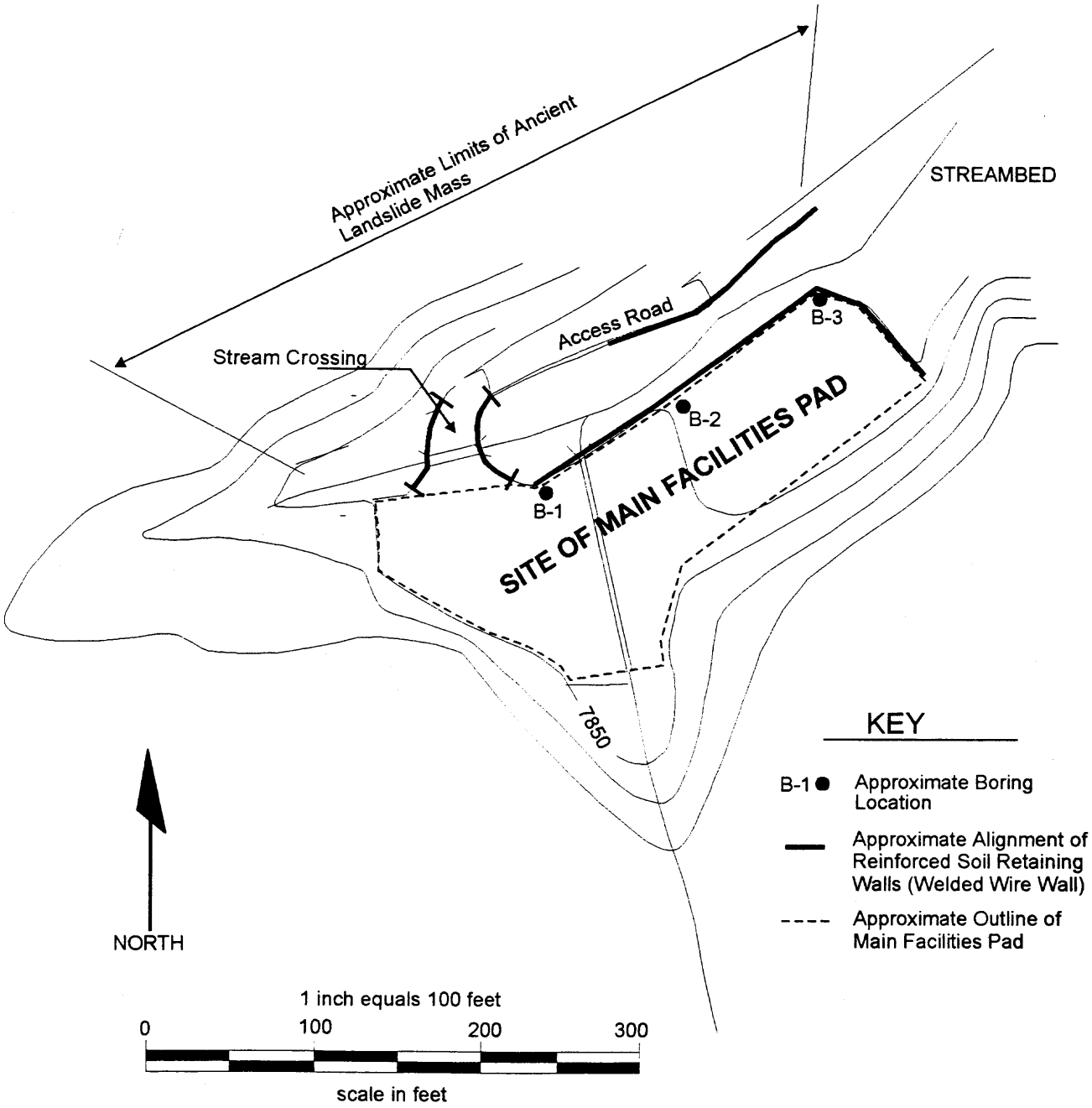


FIGURE 2 - SITE MAP
RILDA CANYON PROJECT

GEOTECHNICAL DESIGN SERVICES INC.

BORING 1

EXISTING GRADE

DEPTH IN FEET

0

9.9 %

5

SM/ GM — Silty Sand and Gravel with occasional cobbles; fine to medium sand, fine and coarse gravel, brown.

AUGER REFUSAL AT 6.5 FEET ON 9/15/95

GROUNDWATER NOT ENCOUNTERED

BORING 2

EXISTING GRADE

DEPTH IN FEET

0

7.2%

SM — Silty fine sand with some medium sand and fine and coarse gravel, brown

5

10.3 % - 109 ■ 20

SM-GM — Silty sand and gravel; fine to medium sand, fine and coarse gravel, medium dense, brown.

10 ■ 60

grades with occasional cobbles

15 ■ 100/6

GM — Silty gravel with some sand; fine and coarse gravel, fine to medium sand, medium dense to dense.

20

6.7% - 121 ■ 42

25 ■ 76

WATER LEVEL AT 28'-10" FEET ON 9/15/95

30

9.5% - 121 ■ 62

Grades with a trace to some clay

35 ■ 58

BORING COMPLETED TO 35.0 FEET ON 9/15/95.

BORING SAMPLED TO 36.5 FEET

BORING 3

EXISTING GRADE

DEPTH IN FEET

0

5.5%

SM — Silty fine sand with a trace to some medium and coarse sand and occasional fine gravel, brown

5 ■ 55

SM/ GM — Sandy gravel/gravelly sand, with some silt, fine to medium sand, fine and coarse gravel, medium dense to dense occasional cobbels and boulders, brown

10

3.3% - 103 ■ 68

grades more gravelly

15 ■ 160

grades more sandy and with more silt

20

5.1% - 121 ■ 88

grades with layers of fine to medium sand and occasional coarse sand/fine gravel, 1" to 5" thick

25 ■ 133

30

11.5% - 126 ■ 49

GC — Clayey sand and gravel, medium dense, with occasional cobbles

WATER LEVEL AT 34'-1" FEET ON 9/15/95

35 ■ 39

GM — Silty gravel with some sand, medium dense, with occasional cobbles

■ 100/1

AUGER REFUSAL AT 38 FEET ON 9/15/95

KEY to SYMBOLS

A% - B ■ C

A% - Gravimetric moisture content, in percent

B - Dry unit wieght of sample, in pcf

C - Blows required to drive a Dames and Moore Type U sampler 12 inches, using a 140 lb hammer dropped 30 inches.

■ Location of sample taken with Type U sampler

▤ Location of disturbed bulk sample

NOTES

The discussion in the text under the section titled "SITE CONDITIONS - SUBSURFACE" is necessary for a complete understanding of the nature of the subsurface conditions and materials encountered.

FIGURE 3
Log of Borings

GEOTECHNICAL DESIGN SERVICES INC.

MAJOR DIVISIONS			GRAPH SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS - More than 50% of soil larger than No. 200 sieve	GRAVEL AND GRAVELLY SOILS - More than 50% of coarse fraction retained on the No. 4 sieve	CLEAN GRAVELS - Little or No Fines		GW	Well Graded Gravels, Gravel-Sand mixtures, little or no fines
				GP	Poorly-graded Gravels, Gravel-Sand mixtures, little or no fines
		GRAVELS WITH FINES - Appreciable amount of fines		GM	Silty Gravels, Gravel-Sand-Silt mixtures
				GC	Clayey Gravels, Gravel-Sand-Clay mixtures
	SAND AND SANDY SOILS - More than 50% of coarse fraction passing the No. 4 sieve.	CLEAN SAND - Little or no fines		SW	Well-Graded Sands, Gravelly Sands, little or no fines
				SP	Poorly-Graded Sands, Gravelly Sands, little or no fines
		Sands with Fines - Appreciable amount of fines		SM	Silty Sands, Sand-Silt mixtures
				SC	Clayey Sands, Sand-Clay mixtures
FINE GRAINED SOILS - More than 50% of soil is smaller than the No. 200 sieve size	SILTS AND CLAYS - Liquid Limit less than 50			ML	Inorganic Silts and very Fine Sands, Rock Flour, Silty or Clayey Fine Sands or Clayey Silts with slight plasticity
				CL	Inorganic Clays of low to medium plasticity, Gravelly Clays, Sandy Clays, Silty Clays, Lean Clays
				OL	Organic Silts and Organic Silty Clays of low plasticity
	SILTS AND CLAYS - Liquid Limit greater than 50			MH	Inorganic Silts, micaceous or diatomaceous fine sand or silty soils
				CH	Inorganic Clays of high plasticity, Fat Clays
				OH	Organic Clays of medium to high plasticity, organic Silts
				PT	Peat, Humus, Swamp Soils with high organic contents

NOTE: Dual Symbols are used to indicate borderline soil classifications

UNIFIED SOIL CLASSIFICATION SYSTEM

SOIL CLASSIFICATION CHART

APPENDIX A

DESIGN MEMORANDUM

Design of Hilfiker Welded Wire Wall
Rilda Canyon Project
for Energy West Mining Company
GDS Job No. 001-95-02

Problem: Design the Main Facilities Pad MSE Retaining Wall system. Use uniform surcharge of 600 psf (for heavy truck traffic). Assume a ϕ value of 36 degrees, for the backfill and foundation conditions. No groundwater allowed with drain system installed. A review of subgrade conditions for the main pad, the stream crossing and the road segments indicates that the same design criteria will be valid for each one.

Reference: NCHRP Report 290, Reinforcement of Earth Slopes and Embankments

Procedure: The design of any reinforced soil wall must satisfy both external and internal stability. External stability analyses are used to determine the primary minimum overall dimensions for the design. The wall is then designed internally, for both tension and pullout. Adjustments are made where necessary to the overall dimensions of the wall at this point. Once this is completed, the basic design parameters for the wall layout are completed.

Step I: Evaluate External Stability

The primary parameters for external stability are total wall height, (H), surcharge loading on top of the wall, (S), soil weight (γ), and shear strength, (ϕ) and (c). Using a minimum acceptable factor of safety of 1.5 for sliding and 2.0 for bearing capacity, a minimum mat length ,(L) can be determined.

For this design, the essential parametric values are as follows:

$S := 600$ in psf $\qquad \phi := 36$ in degrees

$\gamma := 110$ in pcf $\qquad H_o := 2, 4 .. 20$ in feet

$r := 57.29578$ and r is a constant for ease of these calculations

A. Sliding Considerations

The fundamental equation for sliding relates the driving force created by the mass of soil behind the wall to the resisting force mobilized by the wall itself. A minimum factor of safety of 1.5 is required, where the resisting force must be at least 1.5 times greater than the driving force. This equation is as follows:

$$1.5 = \frac{F(resist)}{F(driving)}$$

where $F(resist) = (H\,L\,\gamma + S)\tan\phi$

and $F(drive) = 0.5\,k_a\,\gamma\,H^2$

To evaluate this equation in terms of base width, L, first determine the active pressure coefficient, k_a, for the given soil strength, (ϕ).

$$k_a := \tan\left(\frac{45}{r} - \frac{\phi}{2 \cdot r}\right)^2$$

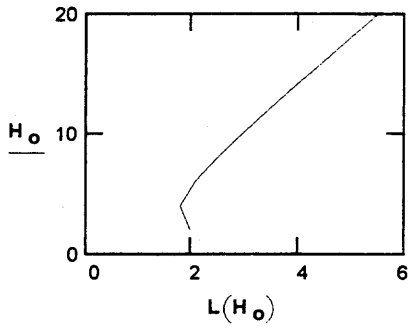
$$k_a = 0.26$$

Then, rearrange the main equation to relate the length, L, to the remaining essential parameters.

$$L(H_o) := \frac{0.75 \cdot k_a \cdot H_o}{\tan\left(\frac{\phi}{r}\right)} + \frac{1.5 \cdot k_a \cdot S}{H_o \cdot \gamma \cdot \tan\left(\frac{\phi}{r}\right)}$$

The results are tabulated and graphed as follows, giving a range of minimumbase width, L, for various heights of the wall, H.

$L(H_o)$
2
1.8
2.1
2.51
2.97
3.46
3.96
4.47
4.99
5.51



These are the minimum mat lengths for the given wall height to satisfy sliding criteria. There is however, a limiting length of 6 feet for the reinforcing mats in order for them to provide any reinforcement to the wall. Additionally, extremely narrow walls (short mat lengths as compared to wall height, commonly expressed as the base to height ratio, α) impose extremely high stress on the subgrade soils and will not provide adequate overturning resistance. Therefore, a minimum base to height ratio will be used for further calculations, and the various other considerations will either verify compliance or this ratio will be increased accordingly. With a fixed base to height ratio, only the maximum wall height requires evaluation for other stability criteria. The maximum height and the α ratio are as follows:

$$H_{max} := 20 \qquad \alpha := 0.65 \qquad L := \alpha \cdot H_{max}$$

B. Evaluate Bearing Capacity Considerations

The evaluation of bearing capacity requirements is done using the classic Meyerhoff distribution of forces. This is a rectangular distribution of forces along the toe of the wall, considering eccentricity. It is well adapted to flexible earth structures which are more prone to uniformly load their foundation rather than rigid concrete structures which will exhibit high toe pressures in a triangular distribution. A factor of safety of 2.0 is considered adequate for most reinforced soil applications, because settlement is usually not a major concern during and immediately after construction.

The eccentricity is first calculated using the following equations

$$e := \frac{\left(k_a \cdot S \cdot H_{max}\right) \cdot \left(\frac{H_{max}}{2}\right) + 0.5 \cdot k_a \cdot \gamma \cdot H_{max}^2}{\left(L \cdot H_{max} \cdot \gamma\right) + S \cdot L}$$

$$e = 1.01$$

With this established, the imposed stress on the subgrade is determined, as follows:

$$\sigma := \frac{L \cdot H_{max} \cdot \gamma + S \cdot L}{L - 2 \cdot e}$$

$$\sigma = 3316.8$$

This result is compared with the allowable bearing capacity determined by classical soil mechanics methods. The approach used for reinforced soil problems is the Terzaghi equation. For this case, the bearing equation is defined by the following constant parameters, followed by the equation used:

$N_\gamma := 35.6$ $\quad$ $N_q := 26.3$ $\quad$ $D_f := 2$

Where N_γ and N_q are fundamental bearing capacity factors, and Df is the toe embedment at the face of the completed wall. This embedment is made partially to improve bearing capacity, and partially to limit the potential for erosion and subsequent undercutting of the wall face.

The resulting allowable bearing capacity is as follows:

$$q_{all} := \left(0.5 \cdot L \cdot \gamma \cdot N_\gamma + \gamma \cdot D_f \cdot N_q\right) \cdot 0.5$$

$$q_{all} = 15620$$

which compares with the imposed stresses of

$$\sigma = 3316.8$$

With the allowable bearing capacity being greater than the imposed stresses, bearing capacity requirements are adequately satisfied.

C. Overturning Analysis

This analysis is performed by taking moments about the toe of the wall, not considering any live load surcharges on the top of the wall (conservative). The analysis essentially considers the resisting weight of the wall against the overturning force of the soil behind it. A factor of safety of 2.0 is considered adequate.

The resisting moment is:

$$M_r = 0.5 \cdot L^2 \cdot H_{max} \cdot \gamma$$

$$M_r = 185900$$

The overturning moment is:

$$M_o = \frac{1}{3} \cdot H_{max} \cdot \left(0.5 \cdot k_a \cdot \gamma \cdot H_{max}^2\right) + 0.5 \cdot k_a \cdot S \cdot H_{max}^2$$

$$M_o = 69230.98$$

The resulting factor of safety against overturning is:

$$\frac{M_r}{M_o} = 2.69$$

Which is greater than the required 2.0 and therefore adequate.

This completes the external stability analysis of the wall. Based upon these considerations, the wall may not be made smaller than the base to height ratio analyzed to this point. To complete the design, the wall must now be designed for internal stability.

Step II: Evaluate and Design Internal Stability

The internal design of a bar mesh reinforced soil mass is done in two stages. The first is the tension design, performed to assure that the individual wires in the mesh have enough strength to withstand the imposed stresses of the soil. The second stage is to evaluate pullout capacity, to assure that there is enough of the bar mesh buried back into the soil behind the theoretical failure plane to retain the reinforced soil mass against the stable soil bank.

A. Tension Design

The diameter of the wire is determined by the tension design. The first step is to determine the appropriate allowance for corrosion of the wires throughout the design life of the structure. The wire must be able to withstand the design tensile loads at the end of the service life of the structure. Therefore, the thickness of the wire which will be corroded during the service life of the structure is added to the required wire size needed to resist the imposed tensile forces in the wire to determine the total cross-sectional area of wire required for the design. The determination of the minimum diameter for the tensile forces is the second step, whereupon the two required thicknesses are added, and the wire requirements are determined.

To evaluate the corrosion potential, the service life of the structure is used to determine how long the wire will last. To begin with, the wire will have a single coat of galvanizing on it, known as commercial galvanizing, which gives a thickness of 0.4 oz/sf of zinc coating. This will is calculated to last for 3 years. After this coat is gone, the bare steel will gradually oxidise over the design life. As noted earlier, at the end of this service life, the minimum wire diameter, dmin, must be present to withstand the imposed soil stresses. The rate at which this corrosion occurs, Cr, has been measured on various reinforced soil and other similar types of applications. The calculations proceed as follows:

$n_{life} = 27$ $\quad$ $C_r = .00072$ inches/year

These are the basic parameters for the corrosion analysis. The value n(life) is the service life of the bare steel. The Cr value is the corrosion rate applicable for the given conditions.

Summing up this rate of corrosion over the service life of the structure, and adding it to the minimum required wire diameter will give the required wire diameter which must be present at the installation of the structure, as follows:

$$d_{sacrificial} := \sum_{i=0}^{n_{life}} C_r$$

$$d_{sacrificial} = 0.02 \text{ inches}$$

Next, determine the tensile strength design requirements over the entire height of the wall, and add to them the amount of sacrificial steel required for the design.

The fundamental parameters to evaluate tension capacity are wire allowable yield strength (fy), wire cross-sectional area (Ar), design lateral pressure coefficient for welded wire walls (Kd), vertical stress imposed at the base of the wall where the stress is the highest (σv), veritcal spacing between wire (Hv), and horizontal spacing between wires (Sv).

$f_a := 35750$ ksi $\qquad K_d := 0.65$

$S_v := 24$ inches $\qquad S_h := 6$ inches $\qquad v := 1.0$

$C_{conversion} := .0069444$

$\sigma(v) := C_{conversion} \cdot \left(H_o \cdot \gamma + S\right)_{(psi)}$

The fundamental relationship is that the allowable strength of the steel must be as great or greater than the imposed stress, as follows:

$$f_a \cdot A(r) \geq K_d \cdot \sigma(v) \cdot S_h \cdot S_v$$

Solving for Ar over the entire wall height for each mat in the wall, the following equation must be satisfied to obtain the minimum cross-sectional area of wire for the wall mats.

$$A(r) := \frac{K_d \cdot \sigma(v) \cdot S_h \cdot S_v}{f_a}$$

This gives the following table of minimum values of of wire diameter for each mat in the wall over its entire height, where the minimum diameter is determines by adding the corrosion allowance to the tensile requirement:

$$d(min) := \sqrt{\frac{4 \cdot A(r)}{\pi}} + d_{sacrificial}$$

H_o	d(min)
2	0.16
4	0.18
6	0.19
8	0.21
10	0.22
12	0.23
14	0.24
16	0.25
18	0.26
20	0.27

The standard wire sizes used for construction are as follows:

W4.5 X 3.5 - .239
W7.0 X 3.5 - .299
W9.5 X 4.0 - .348

Therefore, for walls to a height of 12 use W4.5 X 3.5 mats. For greater heights, use W7.0 X 3.5 wire mats below this level.

B. Pullout Evaluation

To evaluate pullout, the mats must be checked at each level to determine if an adequate factor of safety against pullout exists. The base to height ratio is used to determine the mat total length. To determine how much of this length is effective in resisting pullout forces, it is necessary to determine that portion of each mat which extends past the failure plane within the reinforced soil mass. This effective length is known as L, because it is the only portion of the individual mat that can resist the pullout forces generated by the soil mass in front of the failure plane.

The failure plane is the bilinear failure envelope now commonly accepted for reinforced soil tructures. At the toe of the wall, the failure plane traverses upwards to the mid-height of the wall. At H/2, the failure envelope is vertical up to the ground surface, a distance H/3 back from the wall face.

There are, consequently, two regimes to be evaluated, the first in the upper half of the wall where the effective length, L, is constant and the second in the lower half where L varies with depth.

The pullout force for these two parts is calculated as follows, with constants redefined in terms of feet instead of inches:

$$S_V := 2.0 \text{ feet}$$

For the top half, the pullout force is given by

$$HT := 2, 4 .. 12$$

$$\sigma_{HT} := HT \cdot \gamma + S$$

$$F_{HT} := K_d \cdot \sigma_{HT} \cdot S_V \qquad \text{lbs/foot}$$

and the effective length, L, is given by $\quad L_{HT} := L - \dfrac{H_{max}}{3}$

and for the bottom half, the pullout force is calculated by

$$HB := 14, 16 .. 22$$

$$\sigma_{HB} := HB \cdot \gamma + S$$

$$F_{HB} := K_d \cdot \sigma_{HB} \cdot S_V \qquad \text{lbs/foot}$$

and the effective length, L, is given by

$$L_{HB} = \alpha \cdot H_{max} - \left(\frac{H_{max} - HB}{\tan(\theta)} \right) \qquad \text{where:} \quad \theta := \operatorname{atan}\left[\frac{\frac{H_{max}}{2}}{\left(\frac{H_{max}}{3} \right)} \right]$$

The resistance to pullout is determined by the following equations

$$P_{HT} = 0.02 \cdot \sigma_{HT} \cdot \left[1.5 \cdot \pi \cdot (L_{HT}) \cdot \tan\left(\frac{\phi}{2 \cdot r} \right) + 36 \cdot \left[(L_{HT}) - 1 \right] \right] \qquad \text{top half}$$

and

$$P_{HB} = 2140 + 0.02 \cdot \sigma_{HB} \cdot \left[1.5 \cdot \pi \cdot (L_{HB}) \cdot \tan\left(\frac{\phi}{2 \cdot r} \right) + 18 \cdot \left[(L_{HB}) - 1 \right] \right] \qquad \text{bottom half}$$

which are simplified from the statisically estimated pullout functions listed in the above quoted design reference. This simplification assumes a minimum wire diameter of 0.24 inches at the end of the service life, two longitudinal wires per foot and that the transverse wires are set at 12 inches apart. Addtionally, δ is set equal to $\phi/2$. Finally, it is assumed that the break between the top and the bottom half will be the approximate break between the two different equations used for these calculations.

The factor of safety against pullout is the ratio of the pullout resistance to the pullout force:

$$FS_{HT} = \frac{P_{HT}}{F_{HT}} \qquad FS_{HB} = \frac{P_{HB}}{F_{HB}}$$

Finally, it is necessary to evaluate the ultimate tensile resistance available in the longitudinal wires, or rupture factor of safety. Where this factor of safety is less than the pullout factor of safety,. it will be the governing ratio.

The equation by which the factor of safety against rupture, FSR, is determined is simply the ratio of the maximum force allowed in each mat before yield begins to the pullout force imposed on the mat by the soil. This is dependant on the cross-sectional area of the wire in each mat, and so must be determined according to the wire size at each level. The calculations are performed on a per foot basis, as was the previous calculations for pullout The proceedure is as follows:

$A_1 := 0.045$ $\quad A_2 := 0.070$

$f_y := 65000$ psi $\quad M := 2$ wires/foot

Wire sizes for the two mats in use for this projects, W4.5 and W7.0 longitudinal wires, respectively.

for the upper half of the wall

$$FSR_{HT} := \frac{f_y \cdot A_1 \cdot M}{F_{HT}}$$

for the lower half of the wall

$$FSR_{HB} := \frac{f_y \cdot A_2 \cdot M}{F_{HB}}$$

H_o	L_{HT}	σ_{HT}	F_{HT}	P_{HT}	FS_{HT}	FSR_{HT}
2	6.33	820	1066	3307.84	3.1	5.49
4	6.33	1040	1352	4195.3	3.1	4.33
6	6.33	1260	1638	5082.77	3.1	3.57
8	6.33	1480	1924	5970.24	3.1	3.04
10	6.33	1700	2210	6857.71	3.1	2.65
12	6.33	1920	2496	7745.18	3.1	2.34

L_{HB}	σ_{HB}	F_{HB}	P_{HB}	FS_{HB}	FSR_{HB}
9	2140	2782	8893	3.2	3.27
10.33	2360	3068	10816.39	3.53	2.97
11.67	2580	3354	12968.95	3.87	2.71
13	2800	3640	15350.68	4.22	2.5
14.33	3020	3926	17961.57	4.58	2.32

All of the factors of safety are greater than 2.0, indicating that the wall design is complete. As long as the wall does not exceed the minimum criteria outlined herein, it will be adequate.

APPENDIX B

DESIGN DRAWINGS

RILDA CANYON MINE FACILITIES

WELDED WIRE RETAINING WALL PROJECT PLANS

FOR ENERGY WEST MINING COMPANY
HUNTINGTON, UTAH

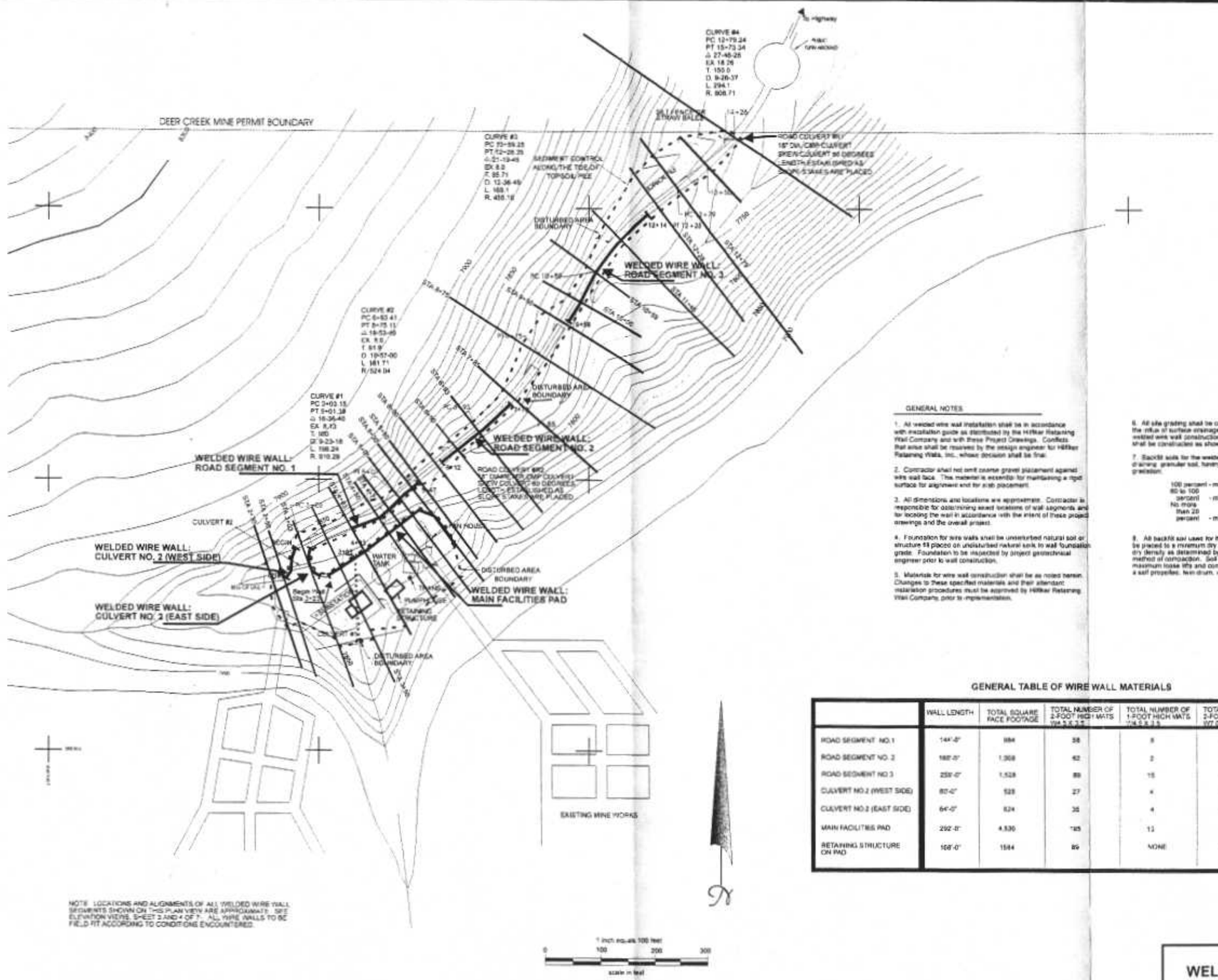
CONTRACT NO. JD T-98

VENDOR: HILFIKER RETAINING WALL COMPANY
EUREKA, CALIFORNIA
HRW JOB NO. 940118-2

DESIGN BY: GEOTECHNICAL DESIGN SERVICES
SALT LAKE CITY, UTAH
GDS JOB NO. 001-95-02

LIST OF SHEETS:

SHEET 1 - TITLE SHEET AND LIST OF DESIGN SHEETS
SHEET 2 - PLAN VIEW, WELDED WIRE WALL ALIGNMENTS
SHEET 3 - ELEVATION VIEWS, ROAD AND CULVERT SEGMENTS
SHEET 4 - MAIN FACILITIES PAD ELEVATIONS; DESIGN CROSS-SECTIONS
SHEET 5 - EARTHWORK CROSS-SECTIONS
SHEET 6 - ADDITIONAL EARTHWORK CROSS-SECTIONS
SHEET 7 - CONSTRUCTION DETAILS



GENERAL NOTES

1. All welded wire wall installation shall be in accordance with installation guide as distributed by the Hilfiker Retaining Wall Company and with these Project Drawings. Conflicts that arise shall be resolved by the design engineer for Hilfiker Retaining Walls, Inc., whose decision shall be final.

2. Contractor shall not omit coarse gravel placement against wire wall face. This material is essential for maintaining a rigid surface for alignment and for slab placement.

3. All dimensions and locations are approximate. Contractor is responsible for establishing exact locations of wall segments and for locating the wall in accordance with the intent of these project drawings and the overall project.

4. Foundation for wire walls shall be undisturbed natural soil or structure fill placed on undisturbed natural soil. In wall foundation grade. Foundation to be inspected by project geotechnical engineer prior to wall construction.

5. Materials for wire wall construction shall be as noted herein. Changes to these specified materials and their attendant installation procedures must be approved by Hilfiker Retaining Wall Company, prior to implementation.

6. All site grading shall be constructed so as to minimize the influx of surface drainage flow into the areas where the welded wire wall construction is present. All internal drainage shall be constructed as shown on the drawings presented herein.

7. Backfill soils for the welded wire walls shall be well-graded, free-draining granular soil, having a PI less than 7 and the following gradation:

100 percent	- minus 6-inch
80 to 100 percent	- minus No. 4 sieve
No more than 20 percent	- minus No. 200 sieve

8. All backfill soil used for the construction of the wire walls shall be placed to a minimum dry density of 90 percent of the maximum dry density as determined by the ASTM D-1557 (modified Proctor) method of compaction. Soil shall be placed in no less than 12-inch maximum loose lifts and compacted by a minimum of 3 passes of a self propelled, twin drum, vibratory compactor.

GENERAL TABLE OF WIRE WALL MATERIALS

	WALL LENGTH	TOTAL SQUARE FACE FOOTAGE	TOTAL NUMBER OF 2-FOOT HIGH MATS WM 5.5 X 2	TOTAL NUMBER OF 1-FOOT HIGH MATS WM 5.5 X 1	TOTAL NUMBER OF 2-FOOT HIGH MATS WF 0 X 2	TOTAL NUMBER OF CAP MATS
ROAD SEGMENT NO.1	144'-0"	884	38	8	NONE	18
ROAD SEGMENT NO. 2	168'-0"	1,008	42	2	NONE	20
ROAD SEGMENT NO.3	258'-0"	1,528	89	15	NONE	32
CULVERT NO.2 (WEST SIDE)	80'-0"	528	27	4	4	8
CULVERT NO.2 (EAST SIDE)	64'-0"	624	35	4	4	8
MAIN FACILITIES PAD	292'-0"	4,830	185	13	102	37
RETAINING STRUCTURE ON PAD	108'-0"	1544	89	NONE	NONE	21

Reference:
Drawing No. CE-10883-EM, Sheet 1 of 1
Deer Creek Mine - Rilda Canyon
Plan View of Surface Facilities and Access Road
Energy West Mining Company

REV NO	DATE	BY	DESCRIPTION
1	10/1/95	JAB	Revised alignments for Culvert No. 1, Main Pad, Culvert No. 2, Road Segment No.1, and Retaining Str on Pad. Revised Table of Materials.

DESIGN BY	DRAWN BY	CHK. BY	APPR. BY
JAB	JAB	JAB	JAB

DATE: 7/31/95
LATEST REVISION: 10/1/95
SCALE: AS NOTED

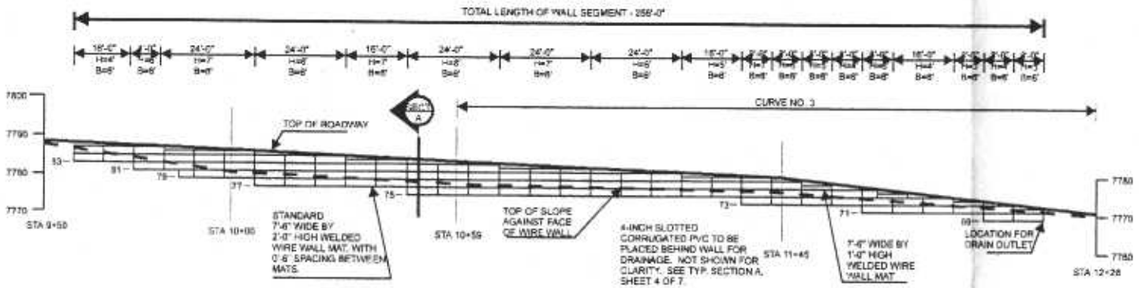
PLAN VIEW
WELDED WIRE WALL ALIGNMENTS
RILDA CANYON PROJECT
FOR ENERGY WEST MINING COMPANY

Designed by
Geotechnical Design Services Inc.
Salt Lake City, Utah (801)323-4888 (phone/fax)

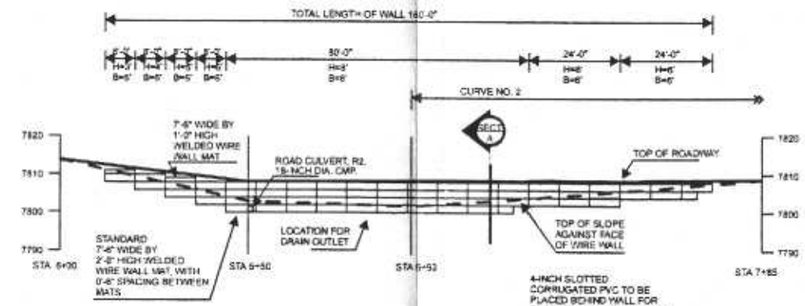
HILFIKER RETAINING WALLS

PROJECT NO. 001-95-02

SHEET NUMBER 2 of 7



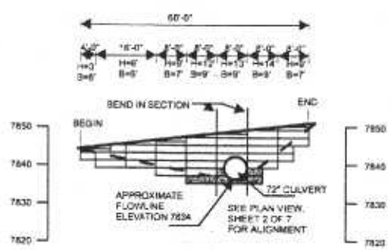
ROAD SEGMENT NO 3
STATION 9+50 TO 12+28



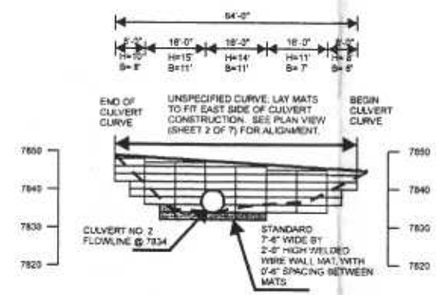
ROAD SEGMENT NO. 2
STATION 6+12 TO 7+72

SEE SHEET 7 OF 7 FOR CONSTRUCTION DETAILS, AS FOLLOWS:

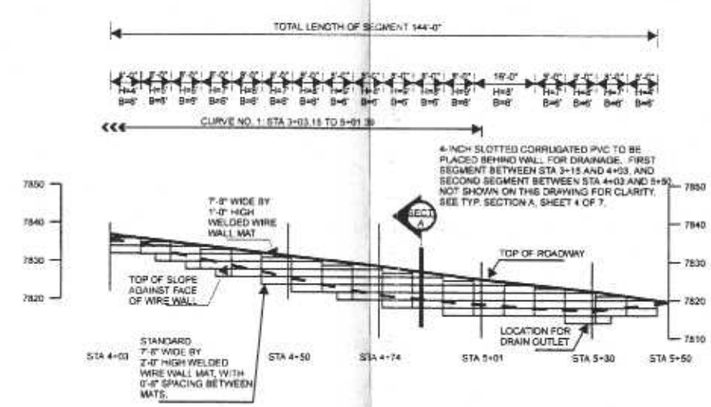
- CONSTRUCTION SEQUENCE - DETAIL 1
- DETAIL AT END OF WALL - DETAIL 2
- CONVEX AND CONCAVE CURVES - DETAILS 3 & 4
- WALL COMPONENTS - DETAIL 5
- FITTING CULVERTS TO WIRE WALL - DETAILS 6, 7, & 8



CULVERT NO. 2 (WEST SIDE)



CULVERT NO. 2 (EAST SIDE)



ROAD SEGMENT NO. 1
STATION 4+03 TO 5+47

KEY TO WIRE MAT SIZING

W4.5 x 3.5 MATS

W7.0 x 3.5 MATS

1 inch equals 20 feet, both horizontal and vertical

0 20 40 60

scale in feet

REV NO	DATE	BY	DESCRIPTION
1	10/1/95	JAB	Revise Culvert No. 2 (East Side) and Road Segment No. 1 to be Separate Welded Wire Wall Segments, with grades corrected from field.

DESIGN BY	DRAWN BY	CHKD. BY	APPR. BY
JAB	JAB	JAB	JAB

DATE: 7/31/95
LATEST REVISION: 10/1/95
SCALE: AS NOTED

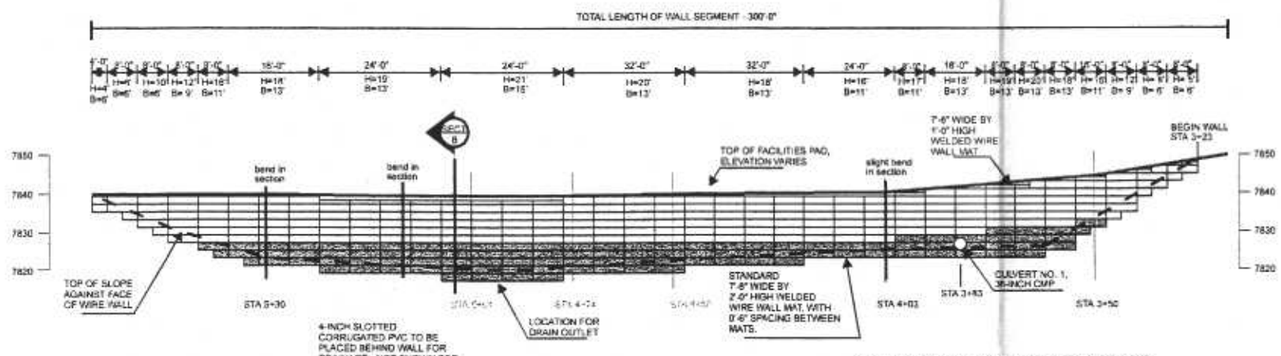
ELEVATION VIEWS
ROAD AND CULVERT SEGMENTS
RILDA CANYON PROJECT
FOR ENERGY WEST MINING COMPANY

Designed by
Geotechnical Design Services Inc.
Salt Lake City, Utah (801)253-4680 (phone/fax)

PROJECT NO:

HILFIKER RETAINING WALLS
PO Box 2012 Eureka, CA 95502-2012
707/443-5092 fax 707/443-3991

SHEET NUMBER: 3 of 7



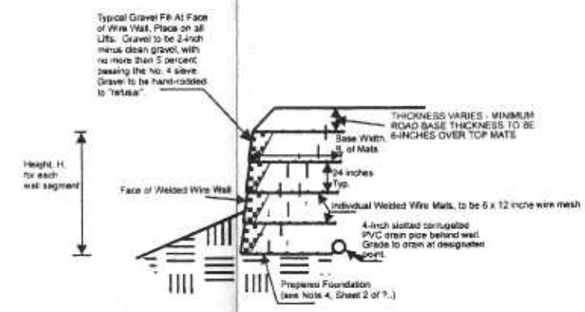
ELEVATION VIEW
MAIN FACILITIES PAD

NOTE: STATIONS SHOWN ARE PROJECTED FROM STATIONING ESTABLISHED ALONG ACCESS ROAD, BY ENERGY WEST MINING COMPANY. AS SUCH, THEY ARE APPROXIMATE, AND DO NOT ACCOUNT FOR VARIATIONS IN WALL ALIGNMENT OR CURVES ON THE ROAD. SEE CROSS-SECTIONS, SHEET 5 OF 7, AND PLAN VIEW SHEET 2 OF 7, FOR ACTUAL LOCATIONS AND DETAILS.

1 inch equals 20 feet, both horizontal and vertical

0 20 40 60

scale in feet



CROSS-SECTION "A"
WELDED WIRE WALL

5 0 5 10

scale in feet

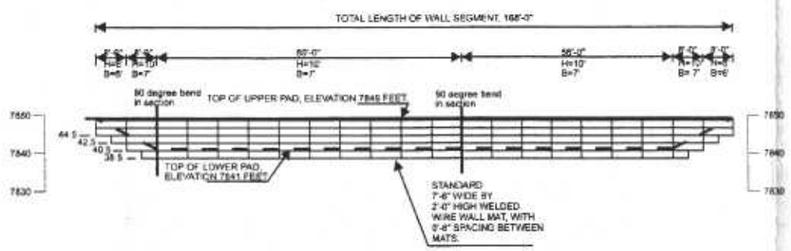
SEE SHEET 7 OF 7 FOR CONSTRUCTION DETAILS, AS FOLLOWS:

- CONSTRUCTION SEQUENCE - DETAIL 1
- DETAIL AT END OF WALL - DETAIL 2
- CONVEX AND CONCAVE CURVES - DETAILS 3 & 4
- WALL COMPONENTS - DETAIL 5
- FITTING CULVERTS TO WIRE WALL - DETAILS 6, 7, & 8

KEY TO WIRE MAT SIZING

W4.5 x 3.5 MATS

W7.0 x 3.5 MATS

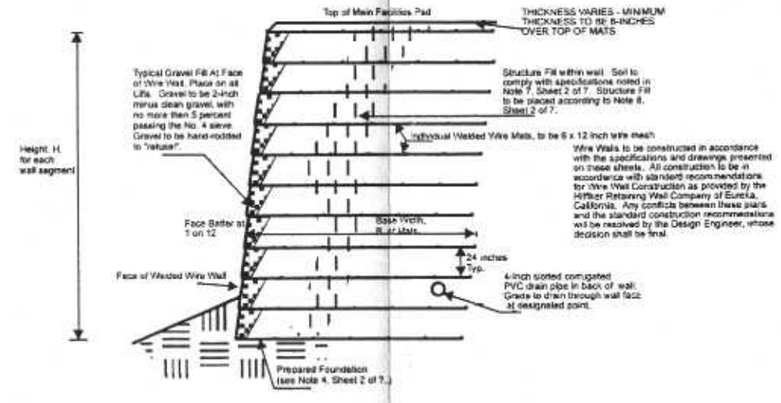


ELEVATION VIEW
RETAINING STRUCTURE ON
MAIN FACILITIES PAD

1 inch equals 20 feet, both horizontal and vertical

0 20 40 60

scale in feet



CROSS-SECTION "B"
WELDED WIRE WALL

5 0 5 10

scale in feet

REV NO.	DATE	BY	DESCRIPTION
1	10/1/95	JAB	Completed design of Main Facilities Pad Elevation and Cross-Sectional Views; Enlarged Retaining Structure on Pad to include North Side

DESIGN BY:	DRAWN BY:	CHKD. BY:	APPR. BY:
JAB	JAB	JAB	JAB

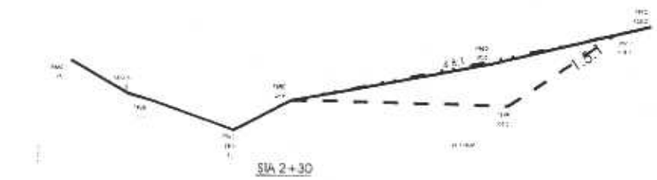
DATE: 7/31/95
LATEST REVISION: 10/1/95
SCALE: AS NOTED

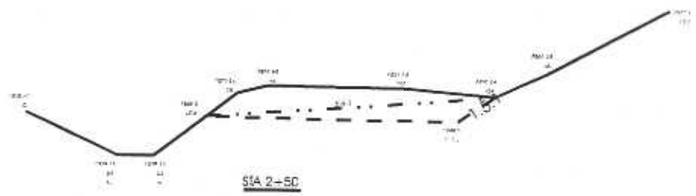
MAIN FACILITIES PAD ELEVATIONS AND DESIGN CROSS-SECTIONS RILDA CANYON PROJECT FOR ENERGY WEST MINING COMPANY

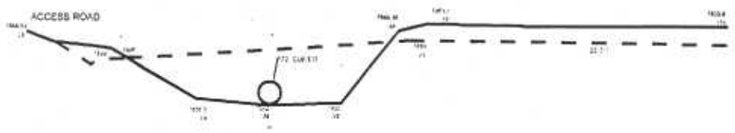
designed by
Geotechnical Design Services Inc.
Salt Lake City, Utah (801)253-4880 (phone/fax)

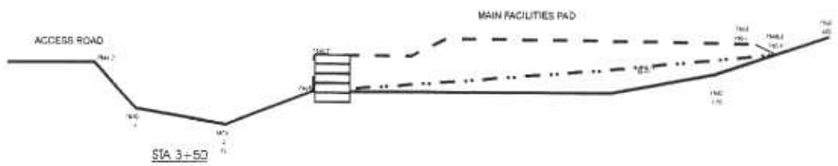
HILFIKER RETAINING WALLS
P.O. Box 3010 Eureka, CA 95502-3010
(707)442-5293 Fax (707)442-2971

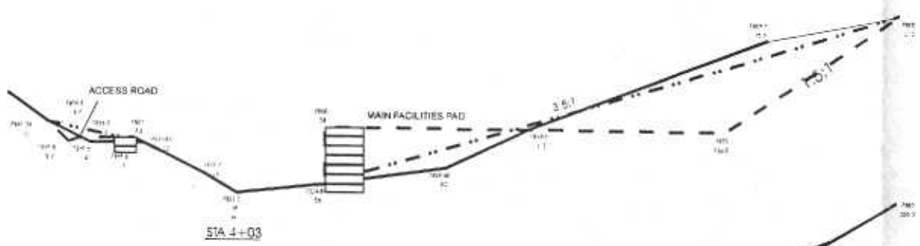
PROJECT NO: 001-95-02
SHEET NUMBER: 4 of 7

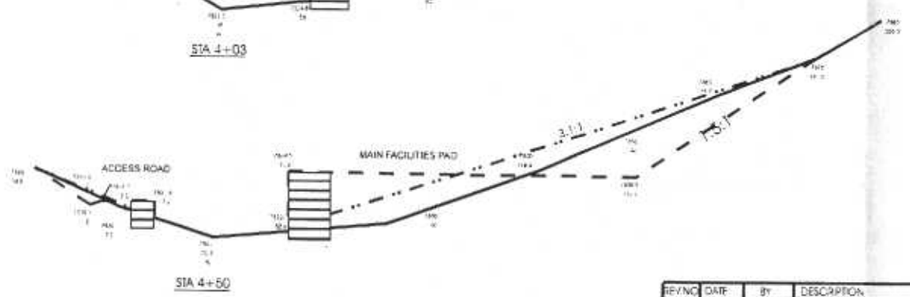










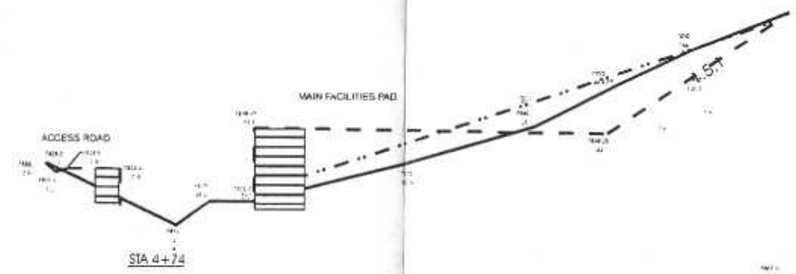


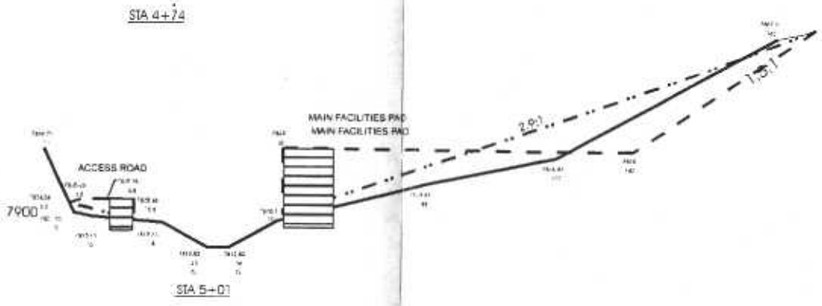
LEGEND

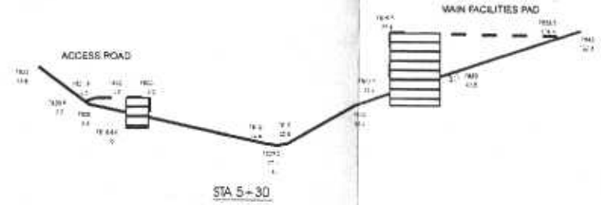
- EXISTING GROUND LINE
- PROPOSED CONSTRUCTION LINE
- FINAL RECLAMATION LINE
- WELDED WIRE WALL (SEE SHEETS 3 AND 4 FOR DESIGN MESH LAYOUT)

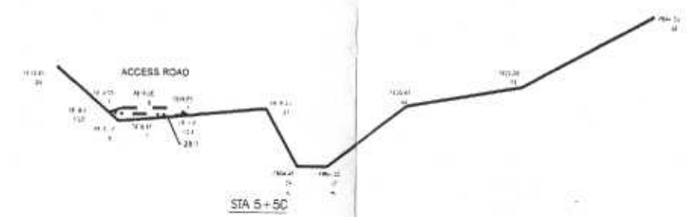
NOTE: SEE PLAN VIEW SHEET 2 OF 7, FOR LOCATIONS OF CROSS-SECTIONS PRESENTED ON THIS SHEET.

0 20 40 60
scale in feet









Reference:
Drawing No. CE 10891-EM Sheets 1&2
East Mountain Property
Rilda Canyon Access Road/Facilities
Cross-Sections
Energy West Mining Company

REV NO	DATE	BY	DESCRIPTION

DESIGN BY:	DRAWN BY:	CHKD. BY:	APPR. BY:
JAB	JAB	JAB	

DATE:
LATEST REVISION:
SCALE: AS NOTED

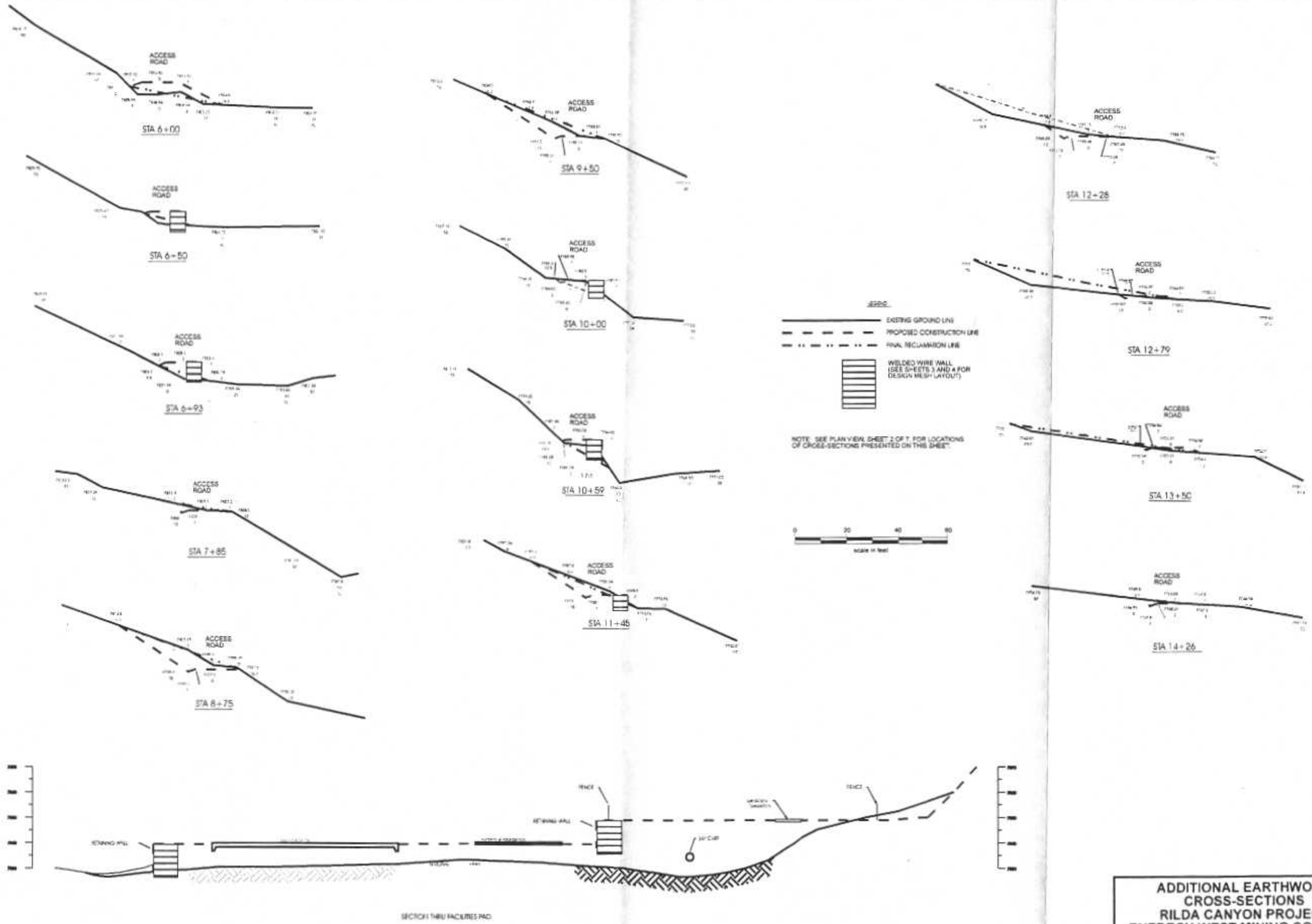
EARTHWORK CROSS-SECTIONS RILDA CANYON PPROJECT FOR ENERGY WEST MINING COMPANY

designed by
Geotechnical Design Services Inc.
Salt Lake City, Utah (801)253-4889 (phone/fax)

PROJECT NO: 001-98-03

HILFIKER RETAINING WALLS
P.O. Box 3012 Eugene, OR 97403-0012
(541)342-5392 fax (541)342-2891

Sheet NUMBER: 5 of 7



Reference:
Drawing No. CE-1988-EM, Sheets 2 & 3
East Mountain Property
Rilda Canyon Property
Cross-Sections
Energy West Mining Company

REV NO	DATE	BY	DESCRIPTION

DESIGN BY	DRAWN BY	CHKD BY	APPR BY
JAB	JAB	JAB	

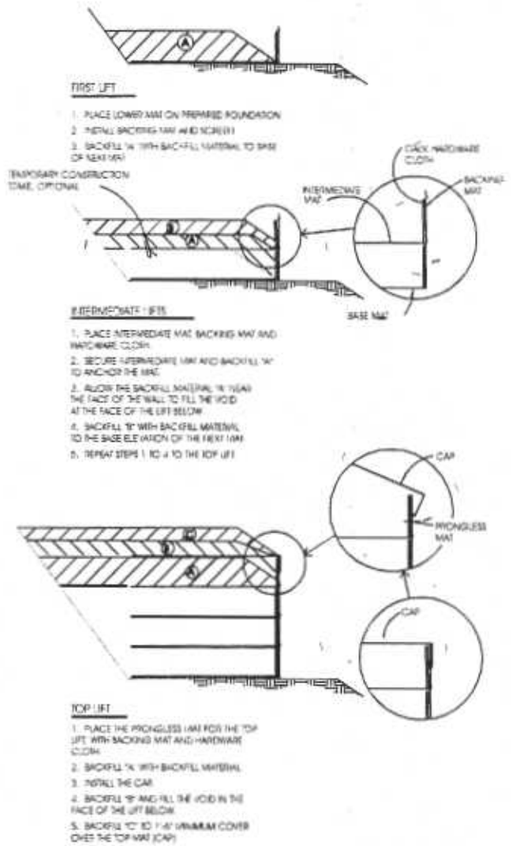
DATE
LATEST REVISION
SCALE: AS NOTED

ADDITIONAL EARTHWORK CROSS-SECTIONS RILDA CANYON PROJECT ENEREGY WEST MINING COMPANY

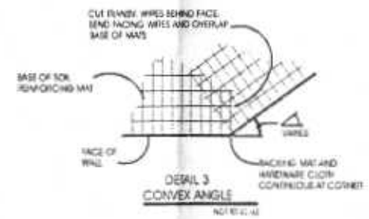
Designed by
Geotechnical Design Services Inc.
Salt Lake City, Utah (801)253-4889 (phone/fax)

HILFIKER RETAINING WALLS
PO Box 2012 Eureka, CA 95502-2012
(707)442-1764 FAX (707)442-2891

PROJECT NO: 001-06-02
SHEET NUMBER: 6 of 7



DETAIL 1
CONSTRUCTION SEQUENCE
NOT TO SCALE



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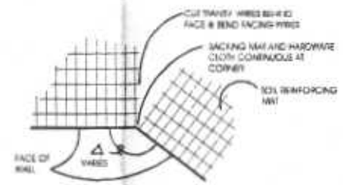

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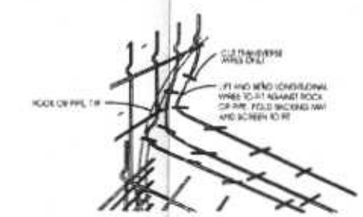

DETAIL 6
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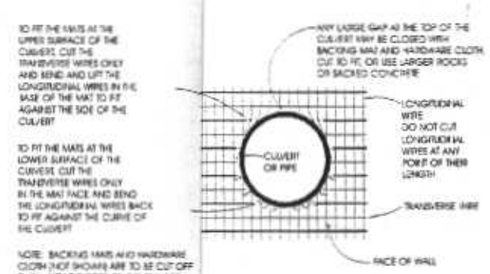
NOT TO SCALE



DETAIL 7
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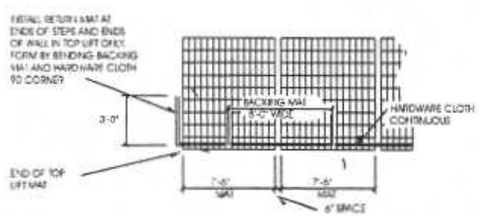
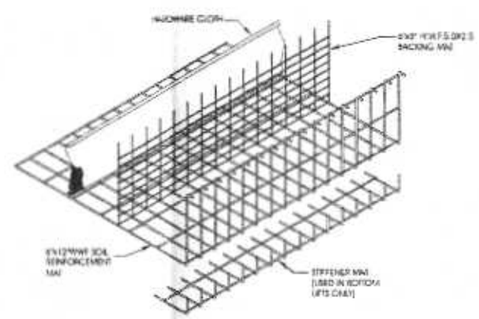


DETAIL 2
END OF WALL
NO SCALE



DETAIL 5
WALL COMPONENTS
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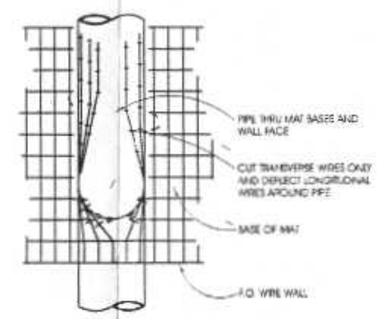

DETAIL 8
PIPE ON ANGLE THRU WALL
NO SCALE

REV NO	DATE	BY	DESCRIPTION

DESIGN BY: JAB | DRAWN BY: JAB | CHKD. BY: JAB | APPR. BY:

DATE:
CREDIT REVISIONS:
SCALE: NO SCALE

CONSTRUCTION DETAILS
WELDED WIRE WALL CONSTRUCTION
RILDA CANYON PROJECT
FOR ENERGY WEST MINING COMPANY

Designed by
Geotechnical Design Services Inc.
Salt Lake City, Utah (801)263-4886 (phone/fax)

PROJECT NO: 001-05-02
SHEET NUMBER: 7 of 7

HILFIKER RETAINING WALLS

amec

PRELIMINARY REPORT
GEOTECHNICAL STUDY
PLANNED LOWER RILDA CANYON
SURFACE FACILITIES
APPROXIMATELY 12 MILES NORTHWEST
OF HUNTINGTON, UTAH
EMERY COUNTY, UTAH

Submitted To:

Energy West Mining Company
15 North Main Street
Huntington, Utah 84528

Submitted By:

AMEC Earth & Environmental, Inc.
Salt Lake City, Utah

September 13, 2004

Job No. 3-817-004643

September 13, 2004
Job No. 3-817-004643

Energy West Mining Company
15 North Main Street
Huntington, Utah 84528

Attention: Mr. Charles A. Semborski
Geology/Permitting Supervisor

Gentlemen:

Re: Preliminary Report
Geotechnical Study
Planned Lower Rilda Canyon Surface Facilities
Approximately 12 miles Northwest of Huntington, Utah
Emery County, Utah

1. INTRODUCTION

1.1 GENERAL

This preliminary report presents the results of our geotechnical study related to surface facilities to be constructed in lower Rilda Canyon in Emery County, Utah for support of the Deer Creek Mine operations. This study considered two sites within Rilda Canyon, both of which are accessed by County Road 306, which extends up the canyon from State Highway 31 (SR-31). The initial site (Site 1) considered during this study is located approximately two miles from the junction of County Road 306 and SR-31. Due to potential permitting and development restrictions associated with that site, the focus of the study shifted to a second site (Site 2) located approximately one-quarter to one-half mile further up Rilda Canyon.

The general locations of both study sites with respect to major topographic features and existing facilities within the vicinity of the sites, as of 1979, are presented on Figure 1, Vicinity Map. A more detailed layout of the facilities proposed for Site 1, along with approximate locations of seismic and subsurface explorations conducted for Site 1, are shown on Figure 2, Site Plan – Site 1. A more detailed layout of the facilities proposed for Site 2 (the current study site) is presented on Figure 3, Site Plan – Site 2. The approximate locations of the seismic explorations conducted at Site 2 in conjunction with this study are also shown on Figure 3.

AMEC Earth & Environmental, Inc.
4137 South 500 West
Salt Lake City, Utah 84123
Tel: +1 (801) 266-0720
Fax: +1 (801) 266-0727

1.2 OBJECTIVES AND SCOPE

The general objectives and initial scope of this study are based on information and requirements outlined in the original request for proposal (RFP) Q1122 and on discussions between Mr. John Christiansen of Energy West Mining Company (Energy West), and Mr. Wade Gilbert of AMEC Earth & Environmental, Inc. (AMEC). The general objectives and initial scope for this study are outlined in our proposal PL03-1102 dated November 4, 2003. Revisions to the initial scope are based on subsequent discussions with Mr. John Christiansen and Mr. Charles Semborski of Energy West.

In general, the objectives of this study are to:

1. Characterize and evaluate subsurface soil, bedrock, and groundwater conditions at the study sites.

2. Evaluate the bedrock profile of Site 2.

3. Provide appropriate geotechnical recommendations for site earthwork, design and construction of building and fan foundations, design and construction of retaining structures, and seismic design of site structures.

In accomplishing these objectives, our scope of services has included the following:

1. Review of available geotechnical and geologic information related to the study sites.

2. A field exploration program consisting of excavating, sampling, and logging 15 test pits and 3 trenches across Site 1 to depths ranging from about 6 to 16 feet below ground surface.

   The required permission to excavate test holes at Site 2 was not obtained for AMEC by the client and therefore a detailed subsurface exploration has not yet been completed at Site 2.

3. A detailed field geologic reconnaissance program at each study site.

4. A geophysical survey program consisting of six seismic refraction lines conducted at Site 1, and four seismic refraction lines at Site 2.

5. A laboratory testing program associated with samples obtained at Site 1.

6. An office program consisting of the correlation of available data, engineering analyses, and the preparation of this summary report.

1.3 AUTHORIZATION

Authorization to proceed with this study was provided under Contract JC-T297 between Energy West Mining Company and AMEC dated November 20, 2003.

1.4 PROFESSIONAL STATEMENTS

Supporting data upon which our discussions and recommendations are based are presented in subsequent sections of this report. Recommendations presented herein are governed by the physical properties of the soils and bedrock encountered in the current and previous explorations, geologic conditions observed during our site reconnaissance activities, projected groundwater conditions, and the layout and design data discussed in Section 2, Proposed Construction, of this report. If subsurface conditions other than those described in this report are encountered and/or if design and layout changes are implemented, AMEC must be informed so that our recommendations can be reviewed and amended, as necessary. Prior to final design of the proposed facilities at Site 2, a site-specific subsurface exploration will be necessary.

Our professional services have been performed, our findings obtained, and our recommendations prepared in accordance with generally accepted engineering principles and practices in use in Utah at this time.

2. PROPOSED CONSTRUCTION

We understand that the planned surface facilities will support mining of new underground areas of the Deer Creek Mine by providing access for personnel and equipment, as well as office, warehouse, and maintenance facilities. Load-out of mined coal will not occur at the planned lower Rilda Canyon facilities, but will take place through a connection to the existing portions of Deer Creek mine. Planned facilities include a new intake portal; a new fan portal and fan facility; a parking garage; a bathhouse/office/warehouse building; a runoff collection tank; a sediment pond at Site 1; an 18-inch CMP overflow pipe extending from the collection tank to the sediment pond; parking and outside storage areas; and miscellaneous minor facilities for storage, fueling, etc. We understand that the layout shown on Figure 3 is subject to change.

Planned buildings are projected to consist of metal-frame structures generating typical light to moderate foundation loads. The planned fan facility will generate relatively light static foundation loads, but must be designed for significant dynamic foundation loads with negligible to no foundation settlement.

Based on current site layout plans, site development will occur on the north side of the existing County Road 306 and will require minor to moderate cuts and fills to establish building pads and parking and storage areas. Site grading is expected to result in finished site grades at or near the existing grades along County Road 306. We understand that the existing road alignment and grades will not be substantially affected. Preparation of building pads, parking areas, and

open storage and yard areas will require cuts into existing slopes on the north side of the canyon and fills with some retaining walls at sharp grade breaks. It is intended to use excavated materials for fills to the extent possible.

We understand that the new intake and fan portals will start at or very near the elevation of the adjacent existing roadway. Both tunnel excavations will extend for a distance of about 400 feet or more from the yard area. Excavated rock may be used as site grading fill to the extent possible.

Site 2 includes a possible spring/groundwater collection area approximately 500 feet up stream of the fan structure along Rilda Canyon Creek. This area is currently under study for that purpose.

3. EXISTING STUDIES AND INFORMATION

Geotechnical studies have been conducted for the existing surface facilities that are located at the upper end of Rilda Canyon. The results of those studies are described in reports dated November 27, 1991[1] and October 16, 1995[2]. The 1991 report includes the results of a seismic refraction investigation conducted at the site of the existing surface facilities.

A soil inventory and assessment was conducted at the Site 1 area. Preliminary information from that study is presented in a draft report dated October 2003[3].

In addition to these studies, Energy West provided drilling and laboratory data related to the Star Point Sandstone formation.

The existing information was used to confirm and correlate information obtained during AMEC's current study at Site 1 for the planned surface facilities. We understand that a rockfall hazard study was conducted by others for the Site 2 area. AMEC has not reviewed that report.

Prior to final design of the proposed facilities at Site 2, a site-specific subsurface exploration will be required to provide soil samples for laboratory testing to confirm preliminary design recommendations as presented in this report.

---

1 "Geotechnical Investigation for Preliminary Design, Rilda Canyon Mine Facilities, Emery County, Utah," RB&G Engineering, Inc.

2 "Report, Geotechnical Evaluation and Design Services, Rilda Canyon Project, Located Near Huntington, Utah, For Energy West Mining Company," Geotechnical Design Services, Inc. Job No. 001-95-02.

3 "Soil Inventory and Assessment, Rilda Canyon Portal and Facilities Site, Deer Creek Mine," EIS Environmental and Engineering Consulting.

4. SITE INVESTIGATIONS

4.1 GENERAL

Investigation of Sites 1 and 2 included a geologic reconnaissance of each site, subsurface explorations at Site 1, and geophysical investigations at both sites. A subsurface exploration program was not conducted for Site 2 due to permitting schedule issues. Observed geologic and surficial soil conditions at Site 2 are generally similar to those at Site 1, and subsurface and laboratory data developed for Site 1 were estimated to be similar to Site 2 for engineering purposes but will require a site-specific subsurface exploration for confirmation. In addition, subsurface information developed by others for the existing upper Rilda Canyon surface facilities indicate that general soil and bedrock conditions are similar between Site 1 and the site of the existing surface facilities. It is also anticipated that the subsurface conditions at Site 2 will also be similar. However, verification will be necessary.

4.2 GEOLOGIC RECONNAISSANCE (SITES 1 AND 2)

A geologic reconnaissance was conducted at each site to help assess local geologic conditions, including past and current geomorphology. The geologic reconnaissance at Site 1 was conducted over several days during the subsurface exploration program and the associated geophysical investigation. The geologic reconnaissance at Site 2 was conducted during the geophysical investigation at that site.

4.3 SUBSURFACE EXPLORATIONS (SITE 1)

Subsurface conditions were explored at Site 1 on April 12 and 13, 2004, by excavating 15 test pits to depths ranging from about 3 to 15 feet below ground surface. Three of the test pits were extended because of local conditions and were also logged as trenches. The test pits and trenches were excavated using a track-mounted hoe. The approximate locations of the test pits and trenches are indicated on Figure 2.

A member of our geologic/geotechnical staff monitored the field exploration program at the site. Our representative maintained a continuous log of the subsurface conditions encountered at each test pit and trench location, and obtained disturbed bulk samples of the soils encountered in the explorations for further examination and testing in our laboratory. The soils were classified by visual and textural examination in the field. These field classifications were later reviewed by subsequent re-examination of the soil samples in our laboratory. Detailed graphical representations of the subsurface conditions encountered in the explorations are presented in Appendix A on Figures A-1 through A-15, Log of Test Pits, and on Figures A-16 and A-17, Log of Test Trenches. The soils were classified in accordance with the nomenclature described on Figure A-18, Unified Soil Classification System.

Sandstone bedrock was encountered in some of the test pits/trenches. No attempt was made to extend the test pits/trenches into bedrock. In addition, excavation refusal was reached in some of the test pits because of large boulders, which could not be removed by the track hoe.

The test pits and trenches were backfilled with material excavated from the test pit or trench. The backfill material was not compacted to specific criteria during placement, and some settlement of the backfill must be expected over time. Energy West personnel spread a mixture of native plant seeds over the backfill at each test pit and trench location.

4.4 GEOPHYSICAL INVESTIGATIONS (SITES 1 AND 2)

Geophysical investigations consisting of seismic refraction lines were conducted at Sites 1 and 2 by LGS Geophysics, Inc. Six seismic refraction lines were conducted at Site 1 in December 2003. The approximate locations of the seismic lines are shown on Figure 2. Four seismic refraction lines were conducted at Site 2 in July 2004. The approximate locations of those seismic lines are shown on Figure 3. The results of the geophysical investigations are summarized in Appendix B, Geophysical Investigation – December 2003, and Appendix C, Geophysical Investigation – July 2004.

4.5 LABORATORY TESTING (SITE 1)

A laboratory testing program was conducted on composite soil samples from Site 1 to provide data for our engineering analyses. The testing program included determination of in-situ moisture content, full gradation tests, compaction tests, and soil chemical testing for pH and soluble sulfates. A description of our laboratory testing program, including test procedures and results, is presented in Appendix D.

Classification testing was performed to determine soil index properties including natural moisture content and grain-size distribution. The index properties were determined for use in soil classification, correlation of field and other laboratory test data, and specific analyses, including bearing capacity, slope stability, and permeability characteristics. The results of the gradation tests indicate that the natural colluvial soils and surficial fills at Site 1 primarily consist of silty sandy gravel and mixtures of silty sands and gravels. Large gravel, cobbles, and boulders were not included in the gradation tests.

Chemical tests were also conducted to determine the aggressiveness of the site soils with respect to concrete. To determine if the soils will react detrimentally with concrete, pH and soluble sulfates tests were performed on representative samples of the Site 1 soils. The results of the pH testing indicate that the tested soils are mildly to moderately alkaline. The results of the soluble sulfates testing indicate that the tested soils contain negligible amounts of water-soluble sulfates. Based on the above values, the potential of the Site 1 soils to react detrimentally with concrete is considered to be negligible.

Laboratory compaction tests were conducted to determine the maximum dry density and optimum moisture content of the site soils when placed as engineered fills. The results of the compaction tests indicate that fills consisting of predominantly granular soils typical of those encountered at Site 1 (including colluvium) could be compacted to maximum dry densities (rock corrected) ranging from about 128 to 133 pounds per cubic foot at optimum moisture contents ranging from about 9 to 9.5 percent.

5. SITE CONDITIONS

5.1 GEOLOGY

Rilda Canyon is located within the eastern margin of the Wasatch Plateau, which is located in the transition province between the Colorado Plateau and the Basin and Range physiographic provinces (Witkind, Weiss, and Brown, 1987). The Wasatch Plateau is capped entirely by sedimentary rocks, and the steep eastern front of the plateau is the result of weathering and erosion. A number of perennial streams flow off the east side of the plateau, including Muddy Creek, Ferron Creek, Cottonwood Creek, and Huntington Creek, to which Rilda Canyon Creek is tributary.

The sediments forming bedrock in the region were deposited as part of marine, lagoon, and lake environments during late Cretaceous time, about 80 million years ago. Large lagoons and lagoonal swamps were sites of deposition of large amounts of organic materials, which were eventually formed into coal. Associated with the lagoons were beach and near-shore deposits of sand and silt. This series of near-shore and off-shore sediments are now found within the Mesaverde Group, which is a late Cretaceous age series of formations which includes the Price River Formation, Castlegate Sandstone, the Blackhawk Formation, and the Star Point Sandstone.

The sedimentary rocks within the Wasatch Plateau are found in relatively flat beds. Formations exposed along the eastern side of the plateau in the vicinity of the sites consist of Middle Cretaceous age Mancos Shale overlain by the Star Point Sandstone, the Blackhawk Formation, and the Castlegate Sandstone. Coal beds are primarily found within the Blackhawk Formation. The Hiawatha coal bed and the Blind Canyon coal bed, both found within the lower Blackhawk Formation, are both present within the Rilda Canyon area. These coal seams range in thickness from about 4 to 10 feet, with local areas being up to 16 feet thick, and are the focus of exploration and mine development in the area.

The Mancos Shale is a thick sequence of shale, shaly siltstone, and sandstone. The Mancos Shale represents deep-water marine deposits with fluvial and deltaic wedges derived from thrust-belt highlands to the west. Near the study area is the Masuk Member of the Mancos Shale, which is a light gray to dark gray, thin- to medium-bedded shale and siltstone with rare, thin interbeds of brown sandstone.

Sedimentary rocks above the Mancos Shale represent mostly fluvial and deltaic deposits with subordinate interbedded marine shales. Just above the Mancos Shale is the Star Point Sandstone, which consists of light brown to brown sandstone, shale, and shaly siltstone. The Star Point Sandstone may actually interfinger eastward of the site with the Mancos Shale. The upper sandstone member of the Star Point Sandstone is called the Spring Canyon Member and outcrops at the site. This is a light bluish-gray to light brownish-gray, medium-grained sandstone that is massive to cross-bedded.

Above the Star Point Sandstone are horizontally-bedded sandstones, shaly siltstones, shales, carbonaceous shales, and coal beds of the Blackhawk Formation. Many thin to thick coal seams are present in the lower portion of this formation. The Hiawatha coal seam is a major coal zone that directly overlies the Star Point Sandstone.

5.2 SEISMICITY

The site is located at the eastern margin of the Intermountain Seismic Belt, which forms parts of the margins of the Basin and Range province. The Wasatch fault zone is located within the Intermountain Seismic Belt and has the potential for magnitude 7.3 earthquakes. The southern end of the Wasatch fault zone is located near Fayette, Utah, approximately 40 miles west of the site.

North-south trending en-echelon faults are present within the Wasatch Plateau. A major graben structure is present along Joes Valley only about 5 miles west of the site. Normal faults, which form the grabens, are within the Joes Valley fault zone, and the nature of these faults suggests they may have formed in response to uplift across the Wasatch monocline (Hecker, 1993). Investigations of two moderate-magnitude earthquakes beneath and east of the Wasatch Plateau indicate that left-lateral shear is occurring on north-northeast-striking Precambrian basement faults in the region. Shearing at depth is consistent with the right-stepping, en-echelon pattern of grabens as seen on the Plateau.

A blind, steeply-dipping, normal fault has been identified within the Wasatch monocline based on surface and drill-hole data, seismic profiles, and gravity surveys. It is possible that basin-range extension may cross this fault and could be transferred to the faults on the Wasatch Plateau (Hecker, 1993). If this blind fault is active, it may be capable of producing large-magnitude earthquakes.

The Joes Valley faults are about 57 km (35 miles) in length, and earthquakes generated by these faults are estimated to have a magnitude of up to 7.1 (Halling, et al, 2002). A large-magnitude earthquake within the Joes Valley fault zone could result in major ground shaking at the lower Rilda Canyon site.

5.3 SURFACE

5.3.1 General

The sites are located within the mid- to lower-portion of Rilda Canyon between elevations of about 7400 and 7800 feet. Rilda Canyon is approximately 11 miles northwest of Huntington, Utah on SR-31. Access to Rilda Canyon and the sites is via Emery County Road 306, which is asphalt-paved for a short distance across the Huntington Creek Bridge and then is gravel-surfaced to the sites and the existing upper Rilda Canyon surface facilities.

Rilda Canyon is relatively narrow and steep-sided. The slopes of the canyon consist of vertical and near vertical sandstone outcrops and steep to moderately sloped areas of slope colluvium consisting of a matrix of silt, sand, and gravel containing sandstone boulders. Sandstone outcrops at or near the base of the canyon consist of beds of the Star Point Sandstone formation. Sandstone outcrops in the upper portions of the canyon slopes consist of the beds of the Blackhawk and Castlegate Sandstone formations. Boulders ranging up to automobile size were observed across both sites.

The canyon areas south of Rilda Creek are generally moderately to heavily wooded with a mixture of willows, cottonwood, Douglas fir, aspen, spruce, wild rose, and other shrubs. Along the creek is a layer of forest litter that covers the ground to depths of up to about two feet. South-facing areas to the north of the road are typically more sparsely vegetated with native grasses, sage, cactus, desert shrubs, juniper, pinyon pine, aspen, and a few large pine trees.

5.3.2 Site 1

Site 1 is located about two miles west of SR-31 on County Road 306. This site is an inactive former coal mining area. We understand that surface reclamation of the area was completed in 1988 and included regrading disturbed natural ground areas and waste coal piles, plugging existing mine portals, construction of surface drainage measures, covering regraded waste coal piles with a veneer of soil, and reseeding. Artifacts of the former mine facilities include the remnants of an access road and pad to two former portals apparently associated with the Leroy mine, a graded slope area below the former Leroy Mine access pad that consists in part of waste coal, and a graded area (below the former Rominger Mine portal) near the east end of the site that may include waste coal.

At Site 1, the floor of the canyon is occupied by Rilda Canyon Creek, moderately flat creek bottomland in areas, County Road 306, and a spring-water collection system operated by a local water district. The spring-water collection system is located within a fenced area with limited access. A buried water pipeline extends down the canyon from the collection area.

Areas along and to the south of the creek (generally south of the road) are moderately to heavily wooded, and areas to the north of the road (areas most associated with past mining and reclamation activities) are more sparsely vegetated with natural grasses, brush, and scattered

trees. The creek has incised a relatively deep channel through the bottomland sediments estimated to be about 6 to 8 feet deep and generally about 10 to 15 feet wide.

The central portion of the site north of the road and below the former Leroy mine portals is a broad, moderately sloping reclaimed area covered with sparse vegetation and scattered small boulders. The reclaimed area below the former Rominger Mine portal near the east end of the site is gently sloped and covered with grasses and isolated small to moderate boulders. The former access road to the former Leroy Mine portals is well-defined but is crossed by occasional drainage swales and covered by scattered small to very large boulders. The access area at the former Leroy Mine portals appears to be located on a relatively thick sandstone outcrop (Spring Canyon member of the Star Point Sandstone) and to have been cut into the slope above the sandstone.

5.3.3 Site 2

Site 2 is approximately one-quarter to one-half mile up the canyon from Site 1. No coal mining activities have been conducted at this site.

As with Site 1, the floor of the canyon at Site 2 is occupied by Rilda Canyon Creek, moderately flat creek bottomland in areas, and County Road 306. Areas along and to the south of the creek (south of the road) are moderately to heavily wooded, and areas to the north of the road are more sparsely vegetated with natural grasses, brush, and scattered trees.

At Site 2, which is higher in elevation than Site 1, the Star Point Sandstone outcrops at road level and forms a generally vertical rock face along the northern limits of the planned facilities area. The area between the face of the sandstone outcrop and the road varies in width and is covered by colluvium, which slopes slightly to moderately downward toward the road. Portions of the road appear to have been cut into the toe of the colluvial slope. Rock outcrops and colluvial deposits were observed to extend further up the canyon slope, including above the Star Point Sandstone outcrop. A significant amount of small to large boulders (rockfall) was observed across the colluvial deposits within and above the planned facilities area.

A proposed spring/groundwater collection area is located at the western end of the site (see Figure 3).

5.4 SUBSURFACE SOIL AND GROUNDWATER

5.4.1 Site 1

Across a significant portion of the site, the surficial soils extending to a depth of about two feet consist of dark brown to reddish-brown silty fine sand with some gravel, cobbles, and boulders. Generally, this surficial material is present throughout the reclaimed area, as shown on Figure 2, and consists of fill placed for replanting of native vegetation during the 1988 reclamation work.

Coal waste was encountered at several of the test pit locations and at the locations of Test Pit/Trench 8 and Test Pit/Trench 15. The depth of coal waste, as seen in Test Pit/Trench 8, was estimated to be 15 feet.

Natural soils encountered across most of the site are considered to be primarily colluvial, with alluvial deposits along the floor of the canyon. The natural soils typically consist of light brown to brown, dense to very dense mixtures of silt, sand, and gravels containing varying amounts of cobbles and boulders. The gravel- to boulder-sized rock fragments have been eroded from large, near-vertical outcrops of moderately-hard, fine-grained sandstone and consist of angular to subangular clasts. The natural colluvial soils were also encountered beneath the coal waste. The natural colluvial soils are expected to exhibit relatively high strength and low compressibility characteristics.

The depth of the colluvial/alluvial soils along Rilda Canyon Creek exceeds 15 feet at the site. A boring drilled in 1991 at a site within the East Fork of Rilda Canyon Creek was extended to a depth of 51 feet without encountering bedrock. This suggests that the depth of colluvium/alluvium near the center of the canyon may exceed 60 feet in local areas. The results of the seismic survey lines conducted at the site also suggest that the depth to bedrock beneath the county road may exceed 60 feet in places.

No groundwater was encountered in any of the test pits or trenches. The soils were all damp to moist, with the moisture content generally increasing slightly with depth.

5.4.2 Site 2

Due to permitting requirements, no test pit or trenches were excavated at Site 2. Based on observed surface conditions and soils exposed in road cuts, as well as the results of the seismic refraction lines, the subsurface soils across the proposed facilities area are projected to be similar to the natural colluvial/alluvial soils encountered at Site 1. The depth to bedrock at the proposed locations of the fan and intake portals is estimated to be on the order of 10 feet. As discussed in the previous section, the depth to bedrock beneath the county road may exceed 60 feet.

Seismic Line 1, completed within the spring collection study area, suggests that the depth to bedrock is only 20 to 25 feet deep at that location. Therefore the thickness of the alluvium at that location could be less than 20 feet. Two borings drilled in 1991 by others in the general vicinity of the spring collection study area encountered alluvium to depths of up to about 26 feet but did not encounter bedrock. The boring logs do not report any groundwater.

Prior to final design, subsurface information obtained at Site 2 will be necessary.

6. DISCUSSIONS AND RECOMMENDATIONS

6.1 DISCUSSIONS OF FINDINGS

From a geotechnical perspective, subsurface soil, bedrock, and groundwater conditions at Site 2 are projected to be generally conducive to construction of the proposed facilities. Undisturbed natural soils and bedrock at the site should provide suitable support to spread foundations, retaining structures, at-grade slabs, and yard and road surfacing.

The primary concerns from a geologic/geotechnical perspective are:

1. The presence of moderate-sized to very large boulders within the colluvium and across the site surface.

2. The potential for structure foundations to be established partly upon colluvial and alluvial soils and partly upon sandstone bedrock.

3. Rockfall hazard.

Boulders will affect site preparation and could impact bearing conditions beneath building footings and retaining walls. The presence of relatively numerous and large boulders will impede site grading and excavation activities. Boulders exposed at design subgrade or present immediately below design subgrade will affect proofrolling of exposed subgrade soils, particularly those soils adjacent to or immediately surrounding boulders. In addition, the presence of boulders at foundation subgrade could result in differential bearing conditions at individual foundation elements or between adjacent foundation elements. Accordingly, subgrade preparation may require the removal of boulders, particularly at individual foundation or retaining wall locations. Excavated boulders must be removed from the planned developed areas, and voids remaining at design subgrade after removal must be backfilled with compacted structural fill.

The site surface is currently covered by a significant amount of boulders, including boulders ranging up to small car size. These boulders are the result of rockfall from upslope sandstone outcrops. We understand that a rockfall hazard study of the site was conducted by others. Rockfall hazard mitigation measures should be considered for the site.

Site groundwater levels are projected to be relatively deep. Groundwater should not affect the construction or performance of building foundations, retaining wall foundations, and yard and roadway surfacing. However, seasonal perched groundwater must be considered possible and be accounted for in design of retaining walls and finished slopes.

Under appropriate conditions, the natural colluvial and alluvial soils projected to underlay the site may be suitable for reuse as structural site grading fill provided they could be placed and appropriately compacted. These natural soils may also be suitable for reuse as structural fill

beneath building foundations provided they meet the requirements for structural fill outlined in Section 6.2.5, Fill Material, of this report. The natural soils contain significant amounts of fines (material passing the No. 200 sieve) and will be difficult to compact if wet or placed during wet weather.

Detailed discussions pertaining to earthwork, foundations, and other related design criteria are presented in the following sections.

6.2 EARTHWORK

6.2.1 General

Site earthwork will include site grading to establish yard and roadway grades, excavation and preparation of building and retaining wall foundations, construction of temporary and permanent soil and bedrock slopes, and excavation and backfilling of utility trenches. Site excavations are projected to encounter primarily granular colluvial and alluvial soils and sandstone bedrock in places.

We understand that site preparation will extend up to the face of the Star Point Sandstone outcrop exposed near the existing road. Some excavation may be required into the sandstone outcrop.

6.2.2 Site Preparation

Prior to initiation of major construction activities, all surface vegetation and topsoil, where encountered, must be stripped from the site, and large root balls grubbed. Vegetation, root balls, and other deleterious materials must be removed from the site. Topsoil, although unsuitable for use as structural fill, may be stockpiled for subsequent landscaping purposes. Based on site conditions, we anticipate that site preparation will encounter negligible amounts of topsoil.

Subsequent to stripping and mass grading, and prior to the placement of footings, slabs, retaining walls, gravel surfacing, and/or structural site grading fill, the exposed natural subgrade within the yard and driveway areas must be proofrolled. Proofrolling must consist of at least three passes with moderate-weight compaction equipment to compact the natural soils exposed by stripping and excavation and to detect possible localized zones of soft or excessively loose soils. If soft, excessively loose, or otherwise unsuitable subgrade soils are encountered during proofrolling, they must be removed to a maximum depth of two feet and replaced with compacted structural fill. Beneath shallow foundations and at-grade slabs and mats, all soft, excessively loose, or otherwise unsuitable soils must be totally removed.

Moderate-size to large boulders must be removed to a depth of at least one foot below the base of footings and at-grade slabs. In yard and driveway areas, boulders may be left in place

provided they do not impede proofrolling activities and soils immediately surrounding the boulders can be appropriately compacted prior to placement of surfacing.

Existing disturbed, natural surficial soils must also be completely removed from beneath shallow foundations, at-grade slabs, and retaining walls. Where yard or roadway surfacing is directly underlain by disturbed soils, the upper eight to nine inches of these soils must be scarified, moisture-conditioned, and recompacted to the requirements for structural fill described in Section 6.2.6, Fill Placement and Compaction. If disturbed natural subgrade soils cannot be properly prepared as recommended, they must be removed as described above and replaced with compacted structural fill.

Natural soils may be reused as site-grading fills within the yard area provided they are placed and compacted in accordance with Section 6.2.6, Fill Placement and Compaction. Natural soils may be reused as structural fill provided they meet the requirements of Section 6.2.5, Fill Material.

6.2.3 Temporary Excavations

Within the natural colluvial and alluvial soils, shallow temporary construction excavations not exceeding four feet in depth or height may be constructed with sideslopes no steeper than one-half horizontal to one vertical. Deeper or higher excavations within the natural colluvial and alluvial soils may be constructed with sideslopes no steeper than one and one-half horizontal to one vertical. Temporary excavations that encounter perched groundwater will require much flatter sideslopes and could require shoring and bracing.

Temporary excavations up to four feet deep or high in moderately to highly fractured bedrock maybe constructed with vertical or near-vertical sideslopes. Excavations up to 15 feet deep or high in moderately to highly fractured bedrock may be constructed with sideslopes no steeper than one quarter horizontal to one vertical. Excavations eight feet deep or higher in slightly fractured to massive bedrock may be constructed with vertical or near-vertical sideslopes. Deeper excavations in slightly fractured to massive sandstone bedrock can be constructed with sideslopes no steeper than one-eighth horizontal to one vertical.

Qualified personnel should inspect all excavations periodically. If any signs of instability or excessive sloughing are noted, immediate remedial action must be initiated. We recommend that temporary slopes higher than six feet be covered with a wire mesh to limit particles from striking construction personnel.

We project that excavation of moderately to highly fractured bedrock can be accomplished with moderate difficulty using a track-mounted hoe. Excavation of slightly fractured to massive bedrock with a conventional track-mounted hoe will be very difficult, if not impossible, particularly in the Star Point Sandstone. Excavation of slightly fractured to massive bedrock will require use of chiseling and breaking equipment, or blasting.

6.2.4 Permanent Slopes

Construction will include permanent cut and fill slopes along the margins of yard and roadway areas. Most of the fills are projected to consist of excavated, on-site, natural granular soils or crushed and screened rock.

Cuts in and fills consisting of the natural site granular soils will be moderately susceptible to erosion due to rain and storm water runoff. To limit potential surface erosion, we recommend that cut and fill slopes of natural granular soils be constructed with sideslopes no steeper than two horizontal to one vertical. In addition, cut and fill slopes of natural soils should be protected from erosion by vegetation or commercially available erosion protection measures until vegetation can become established.

Fills consisting of angular crushed rock will be less susceptible to erosion and can be constructed with slopes no steeper than one and one-half horizontal to one vertical. For stability purposes, the thickness of angular crushed rock fill, measured perpendicular to the face of the slope, must be equal to one-half the height of the fill slope.

Permanent cuts in moderately to highly fractured bedrock should be no steeper than one-half horizontal to one vertical. Permanent cuts in slightly fractured to massive bedrock should be no steeper than one-quarter horizontal to one vertical.

Concentrated storm water or snow melt runoff must be prevented from flowing over permanent cut and fill slopes.

6.2.5 Fill Material

Structural fill is defined as all fill material that will ultimately be subjected to structural loadings, such as those imposed by shallow foundations, at-grade slabs, and gravel surfacing. Structural fill will be required as backfill over and around foundations and utilities, behind retaining walls, as site grading fill, and possibly as replacement fill below shallow foundations, at-grade slabs, and retaining walls. It is recommended that all structural fill be free of sod, rubbish, topsoil, frozen soil, and any other deleterious materials.

For structural site grading fill, the maximum particle size should generally not exceed four inches. However, it should be noted that occasional larger particles not exceeding eight inches in diameter could be incorporated provided that they do not result in "honeycombing" or preclude the obtainment of the desired degree of compaction. The maximum particle size within structural fill placed within confined areas (such as below and adjacent to foundations and within utility trenches) should generally be restricted to two inches.

General imported granular structural fill, where required, should consist of a fairly well-graded mixture of sand and gravel containing less than 18 percent fines (percent by weight of material passing the U.S. No. 200 sieve). Imported granular fill for the fan housing foundations should

consist of a material conforming to the Utah Department of Transportation's specification for granular base.

The existing natural soils are predominantly granular with up to about 30 percent non-plastic fines. These soils may be utilized as structural site grading fill and may be suitable for use as structural fill beneath footings and in confined spaces, provided they meet the above criteria for structural fill.

Since the natural soils have a significant amount of fines, proper compaction of the natural soils will require that close moisture control be maintained during placement and compaction. This will be very difficult during wet weather. Utilization of cleaner, coarser granular soils for structural fill would expedite fill placement and compaction operations during wet weather.

Non-structural site grading fill is defined as all fill material not designated as structural fill and may consist of any cohesive or granular soil not containing excessive amounts of degradable material.

6.2.6 Fill Placement and Compaction

Subsequent to stripping and prior to the placement of structural site grading fill, subgrade areas should be prepared as discussed in Section 6.2.2, Site Preparation, of this report. In confined areas such as shallow foundation excavations or utility trenches, subgrade preparation should consist of the removal of all soft, loose, or disturbed soils.

Structural fill should be placed in horizontal lifts not exceeding eight inches in loose thickness. Structural fill placed to a total thickness in excess of 5 feet or beneath building foundations (regardless of fill thickness) should be compacted over the full depth of the fill to at least 95 percent of the maximum dry density as determined by the AASHTO[4] T-180 (ASTM[5] D-1557) test procedures. Structural fill placed beneath the fan housing foundations must be compacted over the full depth of the fill to at least 97 percent of the maximum dry density. All other structural fill placed to a thickness of less than 5 feet and not beneath foundations should be compacted to at least 90 percent of the above-defined criteria.

Non-structural fill may be placed in lifts not exceeding 12 inches in loose thickness and compacted by at least two passes of construction, spreading, or hauling equipment.

6.2.7 Utility Trenches

All utility trench backfill material below structurally loaded facilities (shallow foundations, yard areas, and access roadways, etc.) should be placed to the same density requirements established for structural fill. Also, prior to construction of any facilities over a backfilled trench,

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4 American Association of State Highway and Transportation Officials
5 American Society for Testing and Materials

the finished subgrade should be proofrolled and/or properly prepared. Proofrolling should consist of two passes of moderately loaded rubber tire-mounted construction equipment over the backfill surface. If excessively loose or soft areas are encountered during proofrolling, they should be removed to a maximum depth of two feet below design finished grade and be replaced with compacted structural fill.

6.3 SHALLOW FOUNDATIONS

6.3.1 Design Criteria

The results of our analyses indicate that the proposed structures may be supported upon conventional shallow spread and continuous foundations established upon suitable, undisturbed, natural granular soils or undisturbed bedrock, and/or upon structural fill extending to suitable, undisturbed, natural granular soils or undisturbed bedrock. Footings supporting the fan housing must be established directly on undisturbed bedrock or on at least three feet of imported structural fill (road base) extending to structural site grading fill, suitable undisturbed natural granular soils, or undisturbed bedrock. It is essential that the foundations not be established over loose surficial soils or non-engineered fills.

For design of foundations and retaining walls established as described, the following preliminary design parameters may be used:

Minimum Recommended Depth of Embedment for Frost Protection **(For foundations requiring frost protection)**	-	42 inches
Minimum Recommended Depth of Embedment for Non-frost Conditions	-	15 inches
Recommended Minimum Width for Isolated Spread Footings	-	24 inches
Recommended Minimum Width for Continuous Strip Footings	-	18 inches
Recommended Net Bearing Pressure For Real Load Conditions	-	3,000 pounds per square foot*
Uniform Bearing Pressure Increase For Seismic Loading	-	50 percent

* Following completion of a subsurface exploration at Site 2 and appropriate laboratory testing, it may be possible to increase the recommended net bearing pressure (for real load conditions) for some foundations.

The term "net bearing pressure" refers to the pressure imposed by the portion of the structure located above lowest adjacent final grade. Therefore, the weight of the footing and backfill to lowest adjacent final grade need not be considered. Real loads are defined as the total of all dead plus frequently applied live loads. Total loads include all dead and live loads, including seismic and wind.

When evaluating the maximum foundation edge bearing pressure for short-term loading conditions, the bearing pressure increase identified above should not be used. For that condition, a maximum bearing pressure increase of 30 percent can be used.

6.3.2 Installation

Shallow foundations and retaining walls must be established upon suitable, undisturbed, natural granular soils or undisturbed bedrock, or upon granular structural fill extending to suitable, undisturbed, natural granular soils or undisturbed bedrock. Footings supporting the fan housing must be underlain by a minimum of three feet of structural fill (road base) extending to properly placed site grading fill, suitable undisturbed natural soils, or undisturbed bedrock.

It is essential that shallow foundations and retaining walls not be established over loose surficial soils, topsoil (if encountered), loose or soft soil, disturbed soil, disturbed or loose bedrock, frozen soil, other deleterious materials, or within ponded water. If natural granular soils or granular structural fills upon which shallow foundations and retaining walls are to be established become disturbed, they should be recompacted to the requirements for structural fill, or be removed and replaced with granular structural fill.

The width of granular structural fill placed beneath shallow foundations and retaining walls must extend laterally at least six inches beyond the edges of the foundations in all directions for each foot of fill thickness beneath the foundations. For example, if the width of the foundation or wall is two feet, and the thickness of the structural fill beneath the foundation or wall is one foot, the width of the structural fill at the base of the foundation excavation would be a total of three feet.

Equipment pads or footings, or retaining walls, may or may not be sensitive to frost heave. The site groundwater table is projected to be relatively deep. However, the natural granular soils contain significant amounts of fine-grained material, and structural fills derived from on site natural soils or bedrock are expected to have significant amounts of fine-grained material. Accordingly, there is a minor potential for frost heave beneath equipment pads and other exterior structures, particularly if a water source is available. For facilities sensitive to vertical movement, we recommend selecting the foundation or pad embedment depth for individual structures based on frost protection requirements.

6.3.3 Settlements

Maximum estimated total settlements of shallow foundations and walls designed and installed in accordance with the recommendations presented herein and supporting the projected loads as discussed in Section 2., Proposed Construction, are anticipated to be less than about one-quarter to one-half of an inch. Differential settlements between adjacent similarly loaded foundations founded on similar soils are estimated to be less than one-half the estimated total settlement. Most of these settlements are expected to occur during construction.

Foundations on bedrock should experience no settlement. Where adjacent foundation elements are founded on dissimilar materials (bedrock and soil), maximum differential settlement will be equivalent to the maximum total settlement of the footing supported on soil.

6.3.4 Lateral Resistance

Lateral loads imposed upon shallow foundations due to wind or seismic forces may be resisted by the development of passive earth pressures and by friction between the base of the foundations and the supporting soils or bedrock. In determining frictional resistance, a coefficient of friction of 0.45 should be utilized. Passive resistance provided by properly placed and compacted granular structural fill may be considered equivalent to a fluid with a density of 300 pounds per cubic foot.

A combination of passive earth resistance and friction may be utilized provided that the friction component of the total is divided by a factor of safety of 1.5.

6.4 AT-GRADE CONCRETE FLOOR SLABS

It is anticipated that the buildings, and possibly the garage, will have at-grade concrete floor slabs. We recommend establishing floor slabs over suitable natural granular soils or bedrock, or on structural site grading fills extending to suitable natural granular soils or bedrock. If concrete slabs are established over finer-grained site grading fills, we recommend that the slabs be underlain by a minimum of three to four inches of "free-draining" granular material such as three-quarters to one-inch minus, clean, gap-graded, angular gravel to facilitate construction and to act as a capillary break. Settlements of floor slabs under projected slab loads of 150 pounds per square foot or less will be negligible.

Where the subgrade of at-grade floor slabs transitions from bedrock to natural soils or site grading fills, we recommend feathering the transition between rock and soil subgrade areas. The intent of this recommendation is to limit creating stress concentrations in the slab due to differential settlement at the transition.

6.5 RETAINING WALLS

6.5.1 General

A retaining structure is proposed between the yard area at the parking garage and the bathhouse/office/warehouse building. The maximum height of this retaining structure is projected to be about eight to ten feet. Retaining structures may also be required at other sharp grade breaks.

Site conditions are conducive to support and construction of a variety of retaining wall types. The natural granular soils will be suitable for use as reinforced fills in mechanically stabilized earth (MSE) retaining walls and as general backfill behind gravity walls or conventional cast-in-place walls. MSE walls and gravity walls are generally easier to build and less costly than conventional cast-in-place walls, and there is a variety of proprietary wall systems available.

Three relatively low cost systems that can be constructed using on-site material include welded wire MSE walls (Hilfiker, etc.), gabion basket gravity walls (Macafferi, etc.), and MSE walls (Tensar, Mirafi, etc.) constructed of polymer reinforcing with a wrapped face or block or rock facing. Welded wire walls and gabion basket walls would be best suited for construction with shot rock from the tunnel excavations. Use of these systems with the shot rock would result in relatively inexpensive, low-maintenance walls that would also be aesthetically pleasing due to the use of the native sandstone fill.

Retaining walls must meet the embedment criteria described in Section 6.3.1, Design Criteria, and the installation criteria described in Section 6.3.2, Installation, of Section 6.3, Shallow Foundations. Walls that meet those criteria may be designed using the bearing criteria described in Section 6.3.1 and will experience settlements as described in Section 6.3.3, Settlements.

6.5.2 Lateral Earth Pressures

Most retaining structures at the site are projected to be free to rotate under lateral load and will therefore be designed to resist active earth pressures. Buried structures that will be restrained from rotating will be designed for at-rest lateral earth pressures.

In evaluating lateral earth pressure parameters, we have assumed that the backfill material supported by the retaining structures and soils resisting lateral movement will have a unit weight of 130 pounds per cubic foot and an internal friction angle of 35 degrees. In evaluating the lateral earth pressure parameters, a level back slope was projected.

The following table lists the lateral earth pressure criteria for both static and seismic conditions. The seismic lateral earth pressures are based on a USGS horizontal ground acceleration coefficient value of 0.37, which corresponds to an average ground motion return periods of 2,475 years. The acceleration value was reduced by 50 percent to obtain the horizontal coefficients used in the calculations. This horizontal coefficient includes amplification for a Site Class "C" soil profile.

Load Condition	Equivalent Fluid Density (pcf)	
	Static	2,475-Year Event
Active (free to rotate) – Level Back Slope	35	40[1]
At-Rest (retrained)	55	30[2]
Passive – Level Fore Slope	300[3]	320[4]

[1] Total value Including static equivalent fluid density.
[2] Seismic value only. Must be added to static value.
[3] Factor of safety of 1.5
[4] Factor of safety of 1.0

The active and at-rest lateral earth pressure criteria provided in the preceding table do not include compaction induced horizontal stresses.

It should be noted that the equivalent fluid density values provided above are based on the assumption that the backfill materials will not become saturated. The equivalent fluid density values may be decreased by 50 percent if the backfill becomes saturated. However, full hydrostatic water pressures will have to be included.

In determining the lateral earth pressures acting on the retaining walls, we recommend the following approaches:

1. Static active earth pressures alone are determined using the above static equivalent fluid density value and are applied using a triangular distribution that increases with depth below top of wall. The total static active force is applied at a point located one-third of the height of the soil retained above the base of the wall.

2. Seismic active earth pressures alone are applied using an "inverted" triangular distribution that decreases with depth below the top of the wall. The total seismic active force is applied at a point above the base of the wall equivalent to six-tenths the height of the retained soil.

3. The total active seismic earth pressure is the summation of the static and seismic components. The total static and seismic active earth pressures may also be approximated using the above seismic equivalent fluid densities applied using a uniform distribution based on one-half the height of the wall times the seismic equivalent fluid density. The total active force is then applied at a point above the base of the wall equivalent to one-half the height of the retained soil.

4. The total at rest seismic earth pressure is the summation of the static and seismic components. At-rest static and seismic earth pressures are determined

using the above equivalent fluid densities. Since compaction-induced stresses will be limited by use of the select wall backfill, the total static at-rest force is determined and applied using a triangular distribution. The total seismic at-rest force is determined using an inverted triangular pressure distribution that decreases with depth. The maximum pressure is based on the height of the wall times the seismic equivalent fluid density. The total seismic at-rest force is applied at a point above the base of the wall equivalent to six-tenths to one-half the height of the retained soil.

5. The passive static and seismic earth pressures can be determined using the above equivalent fluid densities and are both applied using a normal triangular pressure distribution.

Surcharge loads due to vehicles or adjacent structures must be included in the evaluation of lateral earth pressures. To determine the lateral earth pressure due to surcharge loads, the surcharge load (in units of pressure) must be multiplied by a coefficient of 0.33. The resulting surcharge load is applied as a uniform pressure acting over the full height of the retained soil. Surcharge loads located no closer to the back of the retaining structure (back of reinforced zone for MSE walls) than the height of the retaining structure will not generate lateral earth pressures and do not need to be considered in design of the retaining wall.

6.6 GEOSEISMIC SETTING

6.6.1 General

The State of Utah has adopted the International Building Code (IBC) 2003. The IBC 2003 code determines the seismic hazard for a site based upon regional mapping of bedrock accelerations prepared by the United States Geologic Survey (USGS) and the soil site class (formerly soil profile type). The USGS values are presented on maps incorporated into the IBC code and are also available based on latitude and longitude coordinates (grid points).

6.6.2 Soil Class

Based on conditions encountered at the exploration locations, and the results of the seismic refraction investigations, we project that the site subsurface profile to a depth of 100 feet would be classified for dynamic structural analysis as Site Class "C" as defined in Table 1615.1.1, Site Class Definition, of the 2003 IBC.

6.6.3 Site 2 Accelerations

USGS maps provide values of short and long period accelerations for the Site Class "B"-"C" boundary for the 2 percent in 50-year event (2,375-year return period). This site class boundary represents a hypothetical bedrock surface and must be corrected for local soil conditions. The following table summarizes the short and long period bedrock (Class "B"-"C") IBC 2003

accelerations for the 2 percent in 50-year event. The 2-percent in 50-year event is the maximum considered earthquake (MCE) for design. Based on the site latitude and longitude for the sites (39.4035 and -111.1554, respectively, for Site 2) and a Site Class "C" classification, the adjusted acceleration coefficients for the site are as follows:

Spectral Acceleration Value, T Seconds	MCE[1] 2% in 50-Yr event (2,375-yr return), g
Peak Horizontal Ground Acceleration	0.37
0.2 Seconds (Short Period Acceleration, S_S)	0.93
1.0 Seconds (Long Period Acceleration, S_L)	0.37

[1] MCE = Maximum considered earthquake

The adjusted acceleration coefficients for the MCE listed in the preceding table are based on taking the short and long period bedrock accelerations and correcting for the seismic site class using the coefficients F_A and F_V. The design values of the F_A and F_V coefficients used to obtain the acceleration coefficients presented in the preceding table are 1.04 and 1.56, respectively. Per IBC 2003, the short- and long-term acceleration values used in dynamic design are determined by multiplying the adjusted short- and long-term acceleration coefficients by two-thirds (⅔).

6.6.4 Liquefaction

In general terms, liquefaction is defined as the condition when saturated, loose to medium dense, fine-grained, cohesionless, sand-type soils lose their support capabilities because of excessive pore water pressure which develops during a seismic event. Cohesive fine-grained soils typically will not liquefy during a major seismic event, even when saturated.

Based on subsurface conditions encountered at Site 1, the results of the seismic refraction investigations at Site 2, and subsurface information obtained by others for the upper Rilda Canyon facilities, static groundwater is projected to be 25 feet or more below ground surface at the Site 2 facilities area. Groundwater may be shallower along the creek alignment, which is outside of the planned facilities area. Based on a projected absence of static groundwater within at least 25 feet of the ground surface, and the presence of relatively dense granular soils or bedrock to similar depths (bedrock may be shallower) within the facilities area, the site is not considered susceptible to liquefaction.

6.7 CONTAINMENT BASIN

The containment basin was originally to be constructed in the Site 1 area in the vicinity of test pit explorations Test Pits TP-8, TP-9, TP-10, and TP-11. Based on conditions encountered in

those explorations, the site of the pond is underlain by silty gravelly sand (colluvium) and zones of coal waste extending to depths of about 15 feet. We recommend siting the pond east of the location of Test Pit/Trench 8 (TP-8) to limit the possibility of encountering the coal waste.

Based on the results of laboratory grain size analyses, the natural granular soils underlying the proposed pond area are projected to be moderately to highly permeable. Downhole permeability testing conducted by others in 1991 resulted in measured permeabilities ranging from 31 to 13,200 feet per year, with most of the test results between 4,200 and 13,200 feet per year.

If containment is the goal, we recommend installing a liner consisting of either compacted clay or a flexible membrane. Regardless of type, the liner must meet the permeability criteria set by the appropriate governing entity. Minimum permeability criteria previously established by the United States Environmental Protection Agency (USEPA) required a maximum permeability of 1×10^{-6} cm per second for typical containment liners. More stringent criteria may govern depending on the application. While clay liners can be constructed to meet a criteria of 1×10^{-6} cm per second, or lower, meeting a significantly lower permeability requirement would likely require use of a flexible membrane liner.

6.8 CEMENT TYPES

Laboratory tests indicate that the site soils contain negligible amounts of water-soluble sulfates. Therefore, all concrete that will be in contact with the site soils may be prepared using Type I or IA cement.

6.9 ADDITIONAL INVESTIGATIONS

Due to the permitting requirements, no test pits or trenches were excavated at Site 2. The recommendations presented in this preliminary report are based upon laboratory test data from soil samples obtained from Site 1, soil conditions anticipated at Site 2 based upon available information, and our experience with similar soil conditions and proposed structures.

Prior to final design of the proposed facilities at Site 2, a site-specific subsurface exploration will be necessary to provide soil samples for laboratory testing to confirm or revise the preliminary design recommendations as presented in this report.

7. REFERENCES

Halling, M.W., Keaton, J.R., Anderson, L.R., and Kohler, W., 2002, Deterministic maximum peak bedrock acceleration maps for Utah: Utah Geological Survey Miscellaneous Publication 02-11, 57 p.

Hecker, S., 1993, Quaternary tectonics of Utah with emphasis on earthquake-hazard characterization: Utah Geological Survey Bulletin 127, 157 p.

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Witkind, I.J., Weiss, M.P., and Brown, TL., 1987, Geologic map of the Manti 30' x 60' Quadrangle, Carbon, Emery, Juab, Sanpete, and Sevier Counties, Utah: U.S. Geological Survey, Miscellaneous Investigations Series, Map I-1631, scale 1: 100,000.

We appreciate the opportunity of providing this service for you. If you have any questions or require additional information, please do not hesitate to contact us.

Respectfully submitted,

AMEC Earth & Environmental, Inc.

Wade Gilbert

J. Wade Gilbert, State of Utah No. 367656
Sr. Geotechnical Engineer

And:

C. Charles Payton

C. Charles Payton, State of Utah No. 5248599
Professional Geologist

Reviewed by:

Douglas G. Beck

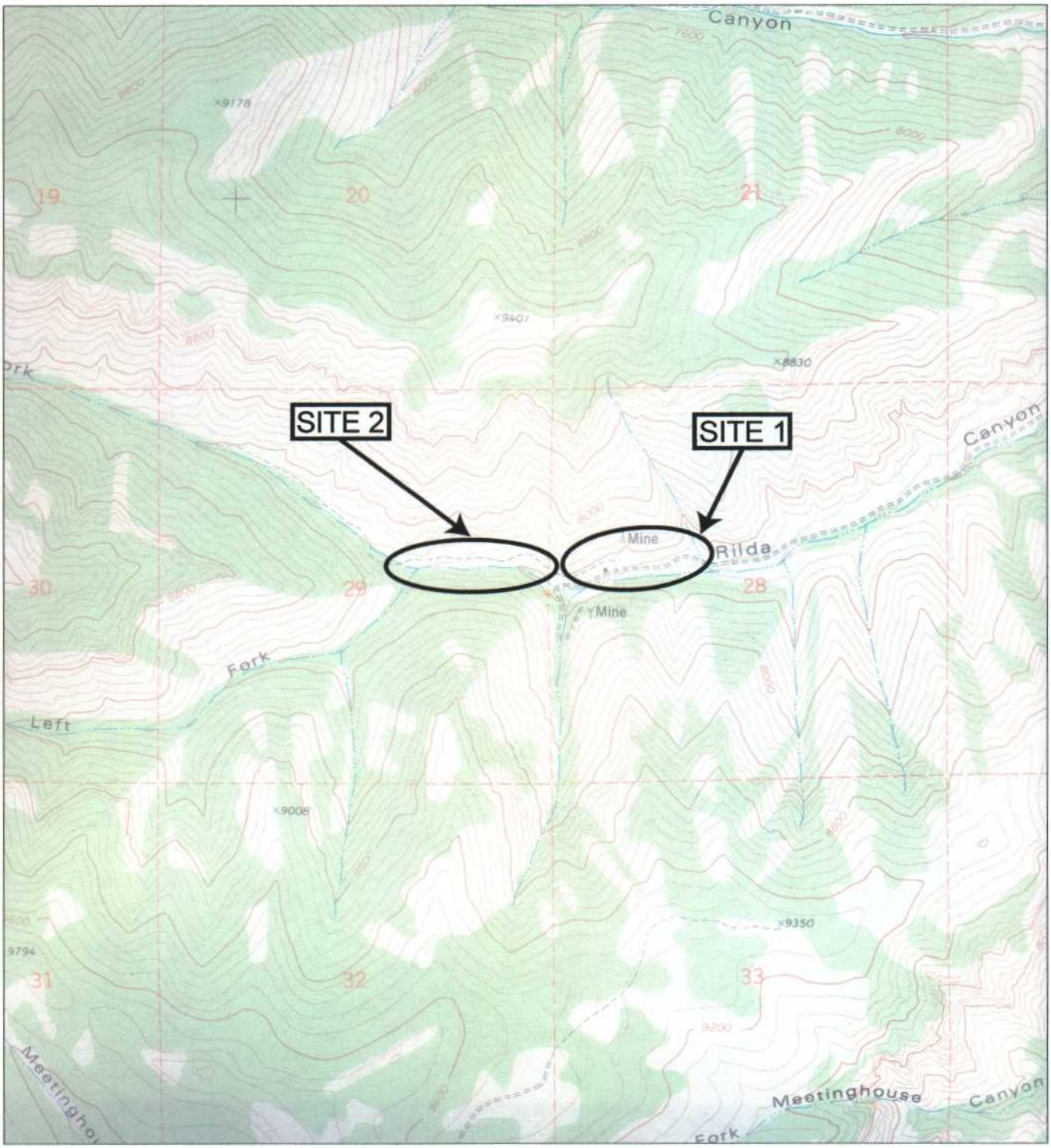
Douglas G. Beck, State of Utah No. 160201
Professional Engineer

JWG /CCP/DGB:sn

Encl.	Figure 1,	Vicinity Map
	Figure 2,	Site Plan – Site 1
	Figure 3,	Site Plan – Site 2
	Appendix A	Field Explorations
	Appendix B	Geophysical Investigation – December 2003
	Appendix C	Geophysical Investigation – July 2004
	Appendix D	Laboratory Testing – Site 1

Addressee (3)

ENERGY WEST MINING COMPANY
JOB NO. 3-817-004643



SCALE IN FEET

1000 0 1000 2000

FIGURE 1
VICINITY MAP

REFERENCE:
USGS 7.5 MINUTE TOPOGRAPHIC QUADRANGLE MAP
TITLED "RILDA CANYON, UTAH"
DATED 1979

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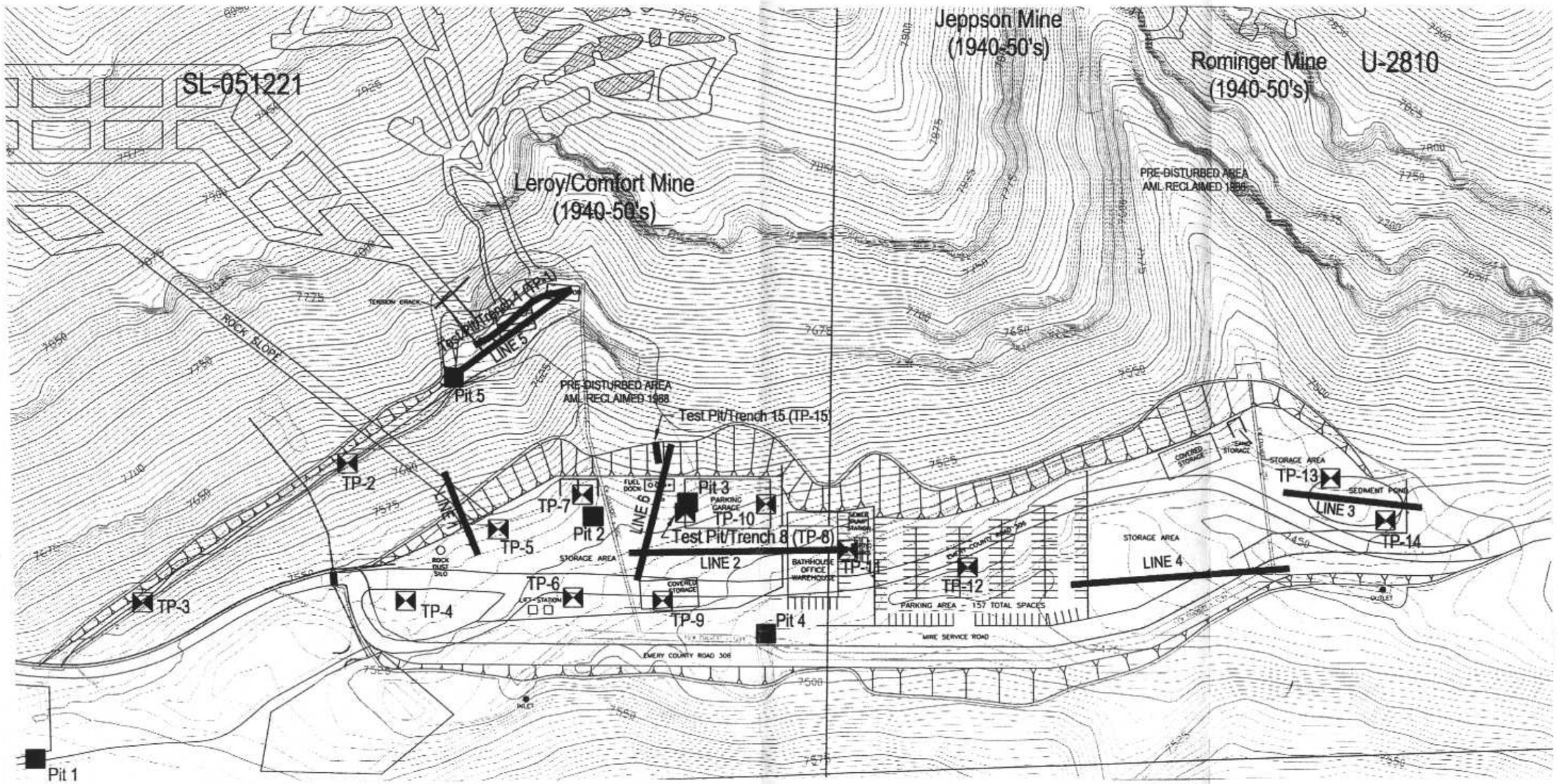
ENERGY WEST MINING COMPANY
JOB NO. 3-817-004643



KEY:

- TEST PITS BY OTHERS
- APPROXIMATE LOCATION CURRENT AMEC TEST PITS
- LINE 1 APPROXIMATE LOCATION SEISMIC REFRACTION LINE

150 75 0 150

SCALE IN FEET

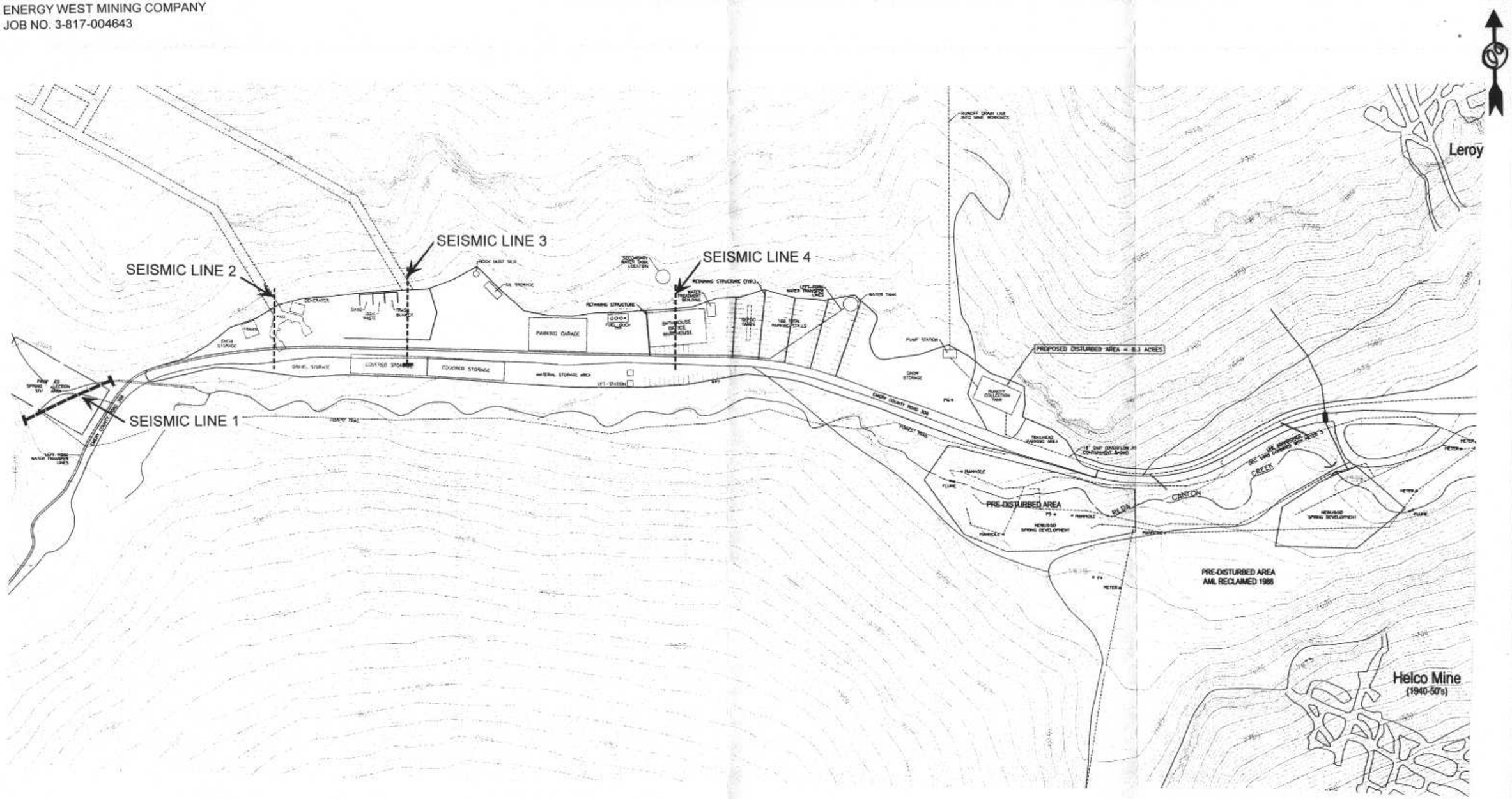
FIGURE 2
SITE PLAN – SITE 1

amec

REFERENCE:
ADAPTED FROM DRAWING
PROVIDED BY ENERGY WEST

N117726

ENERGY WEST MINING COMPANY
JOB NO. 3-817-004643



200 100 0 200

SCALE IN FEET

REFERENCE:
ADAPTED FROM DRAWING
PROVIDED BY ENERGY WEST

FIGURE 3
SITE PLAN-
SITE 2

amec

N517726

APPENDIX A

FIELD EXPLORATIONS

APPENDIX A
FIELD EXPLORATIONS

Subsurface conditions were explored at Site 1 on April 12 and 13, 2004, by excavating 15 test pits to depths ranging from about 3 to 15 feet below ground surface. Three of the test pits were extended because of local conditions and were also logged as trenches. The test pits and trenches were excavated using a track-mounted hoe. The approximate locations of the test pits and trenches are indicated on Figure 2 – Site 1.

A member of our geologic/geotechnical staff monitored the field exploration program at the site. Our representative maintained a continuous log of the subsurface conditions encountered at each test pit and trench location, and obtained disturbed bulk samples of the soils encountered in the explorations for further examination and testing in our laboratory.

The soils encountered in the explorations were classified in the field based on visual and textural examination. These classifications were supplemented by subsequent examination and testing in our laboratory. Soils were classified in general accordance with ASTM D-2488, *Standard Recommended Practice for Description of Soils (Visual-Manual Procedure).* Detailed graphical representations of the subsurface conditions encountered in the explorations are presented on Figures A-1 through A-15, Log of Test Pits, and on Figures A-16 and A-17, Log of Test Trenches. The soils were classified in accordance with the nomenclature described on Figure A-18, Unified Soil Classification System.

Sandstone bedrock was encountered in some of the test pits/trenches. No attempt was made to extend the test pits/trenches into bedrock. In addition, excavation refusal was reached in some of the test pits because of large boulders, which could not be removed by the trackhoe.

The test pits and trenches were backfilled with material excavated from the test pit or trench. The backfill material was not compacted to specific criteria during placement, and some settlement of the backfill must be expected over time. Energy West personnel spread a mixture of native plant seeds over the backfill at each test pit and trench location.

The explorations were located in the field by Energy West using GPS techniques. The ground surface elevations on the boring and test pit logs are based on site topographic contours indicated on Figure 2.

Encl.	Figures	A-1	through A-15, Log of Test Pits
	Figures	A-16	and A-17, Log of Test Trenches
	Figure	A-18,	Unified Soil Classification System

PROJECT Lower Rilda Canyon Surface Facilities
County Road 306, Emery County, UT

JOB NO. 3-817-004643 DATE 04-12-04

LOG OF TEST PIT NO. TP-1

GROUNDWATER		
DEPTH	HOUR	DATE
	*	

BACKHOE TYPE Cat 325 BL
LOCATION
ELEVATION 7670+/-
DATUM

Depth in Feet	Graphical Log	Sample	Sample Type	Moisture in % Dry Wt	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0					SM	moist, "loose"	**SILTY SAND** with fine and coarse gravel, cobbles, and boulders; fine to coarse sand; colluvium; dark brown to reddish-brown
					SS		**SANDSTONE**; fine to medium-grained, cross-bedded; moderately hard; slightly weathered Star Point Standstone; light yellowish-brown color; BEDROCK
5							
							Depth of trench variable. Length approximately 160'. Excavated down to bedrock. * Groundwater not encountered. See trench log (Trench 1).
10							
15							
20							The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary to a proper understanding of the nature of the subsurface materials.
25							

SAMPLE TYPE
B - Bucket Sample
D - Disturbed Bulk Sample
SW - Sidewall Sample
TW - Thinwall Sample

FIGURE A-1

amec

PROJECT Lower Rilda Canyon Surface Facilities
County Road 306, Emery County, UT

JOB NO. 3-817-004643 DATE 04-12-04

LOG OF TEST PIT NO. TP-2

GROUNDWATER		
DEPTH	HOUR	DATE
	*	

BACKHOE TYPE Cat 325 BL
LOCATION
ELEVATION 7623+/-
DATUM

Depth in Feet	Graphical Log	Sample	Sample Type	Moisture in % Dry Density Pcf	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0					SM	moist, "loose" to "medium dense"	**SILTY GRAVELLY SAND**; fine to coarse sand; fine and coarse gravel; boulder-sized rock fragments; subangular and slightly weathered clasts; light brown to brown color; COLLUVIUM
5			D	10.9			
10							Trackhoe refusal. * Groundwater not encountered.
15							
20							The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary to a proper understanding of the nature of the subsurface materials.
25							

SAMPLE TYPE
B - Bucket Sample
D - Disturbed Bulk Sample
SW - Sidewall Sample
TW - Thinwall Sample

FIGURE A-2

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PROJECT Lower Rilda Canyon Surface Facilities
County Road 306, Emery County, UT

JOB NO. 3-817-004643 DATE 04-12-04

LOG OF TEST PIT NO. TP-3

BACKHOE TYPE Cat 325 BL
LOCATION
ELEVATION 7590+/-
DATUM

GROUNDWATER

DEPTH	HOUR	DATE
	*	

Depth in Feet	Graphical Log	Sample	Sample Type	Moisture In % Dry Density Pcf	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0					SM FILL	moist, "loose" to "medium dense"	**SILTY GRAVELLY SAND**; fine to coarse sand; fine and coarse gravel; some boulders; dense to very dense; brown; colluvium/FILL
			D	12.9			
5					GM/ ML	damp, "very dense"	**SANDY GRAVEL** with some silt; fine to coarse sand; fine and coarse gravel; gravel, cobbles, and boulders are subrounded; hard; light brown; COLLUVIUM
10							Excavation stopped at 9.0'. * Groundwater not encountered.
15							
20							The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary to a proper understanding of the nature of the subsurface materials.
25							

SAMPLE TYPE

B - Bucket Sample
D - Disturbed Bulk Sample
SW - Sidewall Sample
TW - Thinwall Sample

FIGURE A-3

amec

PROJECT Lower Rilda Canyon Surface Facilities
County Road 306, Emery County, UT

JOB NO. 3-817-004643 DATE 04-12-04

LOG OF TEST PIT NO. TP-4

GROUNDWATER

DEPTH	HOUR	DATE
	*	

BACKHOE TYPE Cat 325 BL
LOCATION
ELEVATION 7537+/-
DATUM

Depth in Feet	Graphical Log	Sample	Sample Type	Moisture % Dry Density Pcf	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0					SM/GM FILL	moist, "loose" to "medium dense"	**SILTY GRAVELLY SAND/SILTY SANDY GRAVELS - MIXED**; fine to medium sand; fine and coarse gravels; angular to subangular; hard dark brown; FILL
		=	D	13.9			
5					SM	moist, "dense"	**SILTY GRAVELLY SAND**; fine to coarse sand; fine and coarse gravel; clasts are subangular to subrounded; medium brown; COLLUVIUM
		=	D	9.3			
10							
		=	D	9.7			
15							Excavation stopped at 15.0'. * Groundwater not encountered.
20							The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary to a proper understanding of the nature of the subsurface materials.
25							

SAMPLE TYPE
B - Bucket Sample
D - Disturbed Bulk Sample
SW - Sidewall Sample
TW - Thinwall Sample

FIGURE A-4

amec

PROJECT Lower Rilda Canyon Surface Facilities
County Road 306, Emery County, UT

JOB NO. 3-817-004643 DATE 04-13-04

LOG OF TEST PIT NO. TP-5

GROUNDWATER		
DEPTH	HOUR	DATE
	*	

BACKHOE TYPE Cat 325 BL
LOCATION
ELEVATION 7543+/-
DATUM

Depth in Feet	Graphical Log	Sample	Sample Type	Moisture in % Dry Wt	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			D	9.4	SM	moist, "medium dense"	**SILTY GRAVELLY SAND**; fine to coarse sand; fine and coarse gravel; some cobbles and boulders; brown; COLLUVIUM
					SM	moist, "very dense"	**SILTY GRAVELLY SAND**; fine to coarse sand; fine and coarse gravel; boulders; angular to subangular; light brown; COLLUVIUM
5			D	12.7			
							Trackhoe refusal at 8.0'.
							* Groundwater not encountered.
10							
15							
20							The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary to a proper understanding of the nature of the subsurface materials.
25							

SAMPLE TYPE

B - Bucket Sample
D - Disturbed Bulk Sample
SW - Sidewall Sample
TW - Thinwall Sample

FIGURE A-5

amec

PROJECT Lower Rilda Canyon Surface Facilities
County Road 306, Emery County, UT

JOB NO. 3-817-004643 DATE 04-12-04

LOG OF TEST PIT NO. TP-6

GROUNDWATER		
DEPTH	HOUR	DATE
	*	

BACKHOE TYPE Cat 325 BL
LOCATION
ELEVATION 7518+/-
DATUM

Depth in Feet	Graphical Log	Sample	Sample Type	Moisture in % Dry Wt	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0					ML/SM FILL	moist, "loose"	**TOPSOIL**; mixture of silt and fine sand; brown; FILL
					FILL	slightly moist, "loose"	**WASTE COAL**; fine gravel-sized with some silt and fine to coarse sand sizes; black
			D	12.4	SM	moist, "dense"	**SILTY GRAVELLY SAND**; fine to coarse sand; fine and coarse gravel; medium brown; COLLUVIUM
5					SM	moist, "medium dense"	**SILTY GRAVELLY SAND** with cobbles; fine to coarse sand; fine and coarse gravel; subangular; light brown; COLLUVIUM
10							
			D	10.3			
15							Excavation stopped at 15.0'. * Groundwater not encountered.
20							The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary to a proper understanding of the nature of the subsurface materials.
25							

SAMPLE TYPE
B - Bucket Sample
D - Disturbed Bulk Sample
SW - Sidewall Sample
TW - Thinwall Sample

FIGURE A-6

amec

PROJECT Lower Rilda Canyon Surface Facilities
County Road 306, Emery County, UT

JOB NO. 3-817-004643 DATE 04-13-04

LOG OF TEST PIT NO. TP-7

GROUNDWATER

DEPTH	HOUR	DATE
	*	

BACKHOE TYPE Cat 325 BL
LOCATION
ELEVATION 7535+/-
DATUM

Depth in Feet	Graphical Log	Sample	Sample Type	Moisture in % Dry Density Pcf	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0			D	13.0	SM FILL	moist, "medium dense"	**SILTY GRAVELLY SAND** with cobbles; fine to coarse sand; fine and coarse gravel; reddish-brown; FILL
					FILL	moist, "medium dense" to "loose"	**MIXED COLLUVIUM COAL WASTE**; silt; fine to coarse sand; fine and coarse gravel; subangular to subrounded; hard; dark brown to black; FILL
5					SM	moist, "very dense"	**SILTY GRAVELLY SAND**; fine to coarse sand; fine and coarse gravel; cobble-to-boulder-sized rock fragments; clasts are subangular; brown; COLLUVIUM
10			D	5.2			
15							Trackhoe refusal at 11.0'. * Groundwater not encountered.
20							The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary to a proper understanding of the nature of the subsurface materials.
25							

SAMPLE TYPE

B - Bucket Sample
D - Disturbed Bulk Sample
SW - Sidewall Sample
TW - Thinwall Sample

FIGURE A-7

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PROJECT Lower Rilda Canyon Surface Facilities
County Road 306, Emery County, UT

JOB NO. 3-817-004643 DATE 04-13-04

LOG OF TEST PIT NO. TP-8

GROUNDWATER

DEPTH	HOUR	DATE
	*	

BACKHOE TYPE Cat 325 BL
LOCATION
ELEVATION 7532+/-
DATUM

Depth in Feet	Graphical Log	Sample	Sample Type	Moisture in % Dry Density Pcf	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0							**COAL WASTE** above colluvium * Groundwater not encountered. See trench log (Trench 8).
5							
10							
15							
20							
25							

SAMPLE TYPE
B - Bucket Sample
D - Disturbed Bulk Sample
SW - Sidewall Sample
TW - Thinwall Sample

FIGURE A-8

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PROJECT Lower Rilda Canyon Surface Facilities
County Road 306, Emery County, UT

LOG OF TEST PIT NO. TP-9

JOB NO. 3-817-004643 DATE 04-13-04

GROUNDWATER		
DEPTH	HOUR	DATE
	*	

BACKHOE TYPE Cat 325 BL
LOCATION
ELEVATION 7507+/-
DATUM

Depth in Feet	Graphical Log	Sample	Sample Type	Moisture in % Dry Wt	Density Pcf	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0						ML/ SM FILL	moist, "loose"	**SILT**; fine to coarse sand; fine and coarse gravel; dark brown; FILL
						SM	moist "loose" to "medium dense"	**SILTY GRAVELLY SAND** with cobbles; fine to medium sand; fine and coarse gravel; brown; COLLUVIUM/ALLUVIUM
			D					
5								
						SM	damp, "very dense"	**SILTY GRAVELLY SAND** with cobbles; fine to coarse sand; fine and coarse gravel; clasts; subangular; light brown; COLLUVIUM/ALLUVIUM
10								
								Trackhoe refusal at 11.0'. * Groundwater not encountered.
15								
20								The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary to a proper understanding of the nature of the subsurface materials.
25								

SAMPLE TYPE
B - Bucket Sample
D - Disturbed Bulk Sample
SW - Sidewall Sample
TW - Thinwall Sample

FIGURE A-9

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PROJECT Lower Rilda Canyon Surface Facilities
County Road 306, Emery County, UT

JOB NO. 3-817-004643 DATE 04-13-04

LOG OF TEST PIT NO. TP-10

GROUNDWATER		
DEPTH	HOUR	DATE
	*	

BACKHOE TYPE Cat 325 BL
LOCATION
ELEVATION 7522+/-
DATUM

Depth in Feet	Graphical Log	Sample	Sample Type	Moisture in % Dry Density Pcf	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0					SM/ML FILL	moist, "loose"	**TOPSOIL**; mixture of silt, fine sand, and gravel; brown; FILL
					FILL	moist, "loose"	**COAL WASTE**; silt, sand, and fine gravel-sizes; black; FILL
5					SM	moist, "very dense"	**SILTY GRAVELLY SAND**; mixture of silt; fine to coarse sand; fine and coarse gravel; some cobbles to boulders; angular to subangular; brown; COLLUVIUM
10			D	8.0			
15							Excavation stopped at 13.0'. * Groundwater not encountered.
20							The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary to a proper understanding of the nature of the subsurface materials.
25							

SAMPLE TYPE
B - Bucket Sample
D - Disturbed Bulk Sample
SW - Sidewall Sample
TW - Thinwall Sample

FIGURE A-10

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PROJECT Lower Rilda Canyon Surface Facilities
County Road 306, Emery County, UT

JOB NO. 3-817-004643 DATE 04-13-04

LOG OF TEST PIT NO. TP-11

GROUNDWATER

DEPTH	HOUR	DATE
	*	

BACKHOE TYPE Cat 325 BL
LOCATION
ELEVATION 7492+/-
DATUM

Depth in Feet	Graphical Log	Sample	Sample Type	Moisture in % Dry Pct	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0					SM	moist, "loose" to "medium dense"	**SILTY GRAVELLY SAND**; fine to coarse sand; fine and coarse gravel; brown; COLLUVIUM
			D				
5							
					SM	damp, "very dense"	**SILTY GRAVELLY SAND**; fine to coarse sand; fine and coarse gravel; some cobbles to boulders; clasts; slightly weathered; subangular; light brown; COLLUVIUM
10							
							Trackhoe refusal at 13.0'.
							* Groundwater not encountered.
15							
20							The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary to a proper understanding of the nature of the subsurface materials.
25							

SAMPLE TYPE

B - Bucket Sample
D - Disturbed Bulk Sample
SW - Sidewall Sample
TW - Thinwall Sample

FIGURE A-11

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PROJECT Lower Rilda Canyon Surface Facilities
County Road 306, Emery County, UT

JOB NO. 3-817-004643 DATE 04-13-04

LOG OF TEST PIT NO. TP-12

GROUNDWATER

DEPTH	HOUR	DATE
	*	

BACKHOE TYPE Cat 325 BL
LOCATION
ELEVATION 7477+/-
DATUM

Depth in Feet	Graphical Log	Sample	Sample Type	Moisture in % Dry Density Pcf	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0					SM/ML/FILL	moist, "loose"	**TOPSOIL**; silt and fine sand; dark gray; FILL
					SM	moist, "loose" to "medium dense"	**SILTY GRAVELLY SAND**; fine to coarse sand; fine and coarse gravel; brown to yellowish-brown; ALLUVIUM
			D				
5							
					SM	moist, "loose" to "medium dense"	**SILTY SAND**; fine to medium sand; plastic fines; light gray; ALLUVIUM
10							bottom of pit 10.0'.
							* Groundwater not encountered.
15							
20							The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary to a proper understanding of the nature of the subsurface materials.
25							

SAMPLE TYPE

B - Bucket Sample
D - Disturbed Bulk Sample
SW - Sidewall Sample
TW - Thinwall Sample

FIGURE A-12

amec

PROJECT Lower Rilda Canyon Surface Facilities
County Road 306, Emery County, UT

JOB NO. 3-817-004643 DATE 04-13-04

LOG OF TEST PIT NO. TP-13

BACKHOE TYPE Cat 325 BL
LOCATION
ELEVATION 7468+/-
DATUM

GROUNDWATER

DEPTH	HOUR	DATE
	*	

Depth in Feet	Graphical Log	Sample	Sample Type	Moisture in % Dry Pct	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0					SM/ML/FILL	moist, "loose"	**TOPSOIL**; silt and fine sand; brown; FILL
					FILL	moist, "loose"	**COAL WASTE**; sand to fine gravel sizes; black; FILL
					SM	moist, "loose" to "medium dense"	**SILTY GRAVELLY SAND**; fine to coarse sand; fine and coarse gravel; light brown; COLLUVIUM
5					GP	moist, "loose"	**SANDY GRAVEL**; fine to medium sand; fine and coarse gravel; subrounded; light brown; COLLUVIUM/ALLUVIUM
					SM		
					SM	moist, "loose"	**SILTY FINE SAND**; dark reddish-brown; ALLUVIUM
						moist, "very dense"	**SILTY GRAVELLY SAND** with cobbles and boulders; fine to coarse sand; fine and coarse gravel; slightly weathered clasts; light brown; COLLUVIUM
10			D				
15							Excavation stopped at 15.0'. * Groundwater not encountered.
20							The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary to a proper understanding of the nature of the subsurface materials.
25							

SAMPLE TYPE
B - Bucket Sample
D - Disturbed Bulk Sample
SW - Sidewall Sample
TW - Thinwall Sample

FIGURE A-13

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PROJECT Lower Rilda Canyon Surface Facilities
County Road 306, Emery County, UT

JOB NO. 3-817-004643 DATE 04-13-04

LOG OF TEST PIT NO. TP-14

GROUNDWATER		
DEPTH	HOUR	DATE
	*	

BACKHOE TYPE Cat 325 BL
LOCATION
ELEVATION 7452+/-
DATUM

Depth in Feet	Graphical Log	Sample	Sample Type	Moisture in % Dry Wt	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0					ML/SM/FILL	moist, "loose"	**TOPSOIL**; silt and fine sand; dark brown; FILL
					SM	moist, "loose"	**SILTY GRAVELLY SAND**; fine to coarse sand; fine and coarse gravel; reddish-brown; COLLUVIUM
			D				
					GP	moist, "loose"	**SANDY GRAVEL**; fine to medium sand; fine and coare gravel; light brown; COLLUVIUM/ALLUVIUM
					SM	moist, "very dense"	**SILTY GRAVELLY SAND** with cobbles and boulders; fine to coarse sand; fine and coarse gravel; slightly bedded; clasts are subrounded to subangular; slightly weathered; light brown; COLLUVIUM/ALLUVIUM
5							
10			D	6.6			
15							Excavation stopped at 13.0'. * Groundwater not encountered.
20							The discussion in the text under the section titled, SUBSURFACE CONDITIONS, is necessary to a proper understanding of the nature of the subsurface materials.
25							

SAMPLE TYPE
B - Bucket Sample
D - Disturbed Bulk Sample
SW - Sidewall Sample
TW - Thinwall Sample

FIGURE A-14

amec

PROJECT Lower Rilda Canyon Surface Facilities
County Road 306, Emery County, UT

JOB NO. 3-817-004643 DATE 04-13-04

LOG OF TEST PIT NO. TP-15

GROUNDWATER

DEPTH	HOUR	DATE
	*	

BACKHOE TYPE Cat 325 BL
LOCATION
ELEVATION 7555+/-
DATUM

Depth in Feet	Graphical Log	Sample	Sample Type	Moisture in % Dry Density Pcf	Unified Soil Classification	REMARKS	VISUAL CLASSIFICATION
0							**COAL WASTE**
							30.0' long trench excavated.
							* Groundwater not encountered.
							See trench log (Trench 15).
5							
10							
15							
20							
25							

SAMPLE TYPE
B - Bucket Sample
D - Disturbed Bulk Sample
SW - Sidewall Sample
TW - Thinwall Sample

FIGURE A-15

amec

ENERGY WEST MINING COMPANY
JOB NO. 3-817-004643

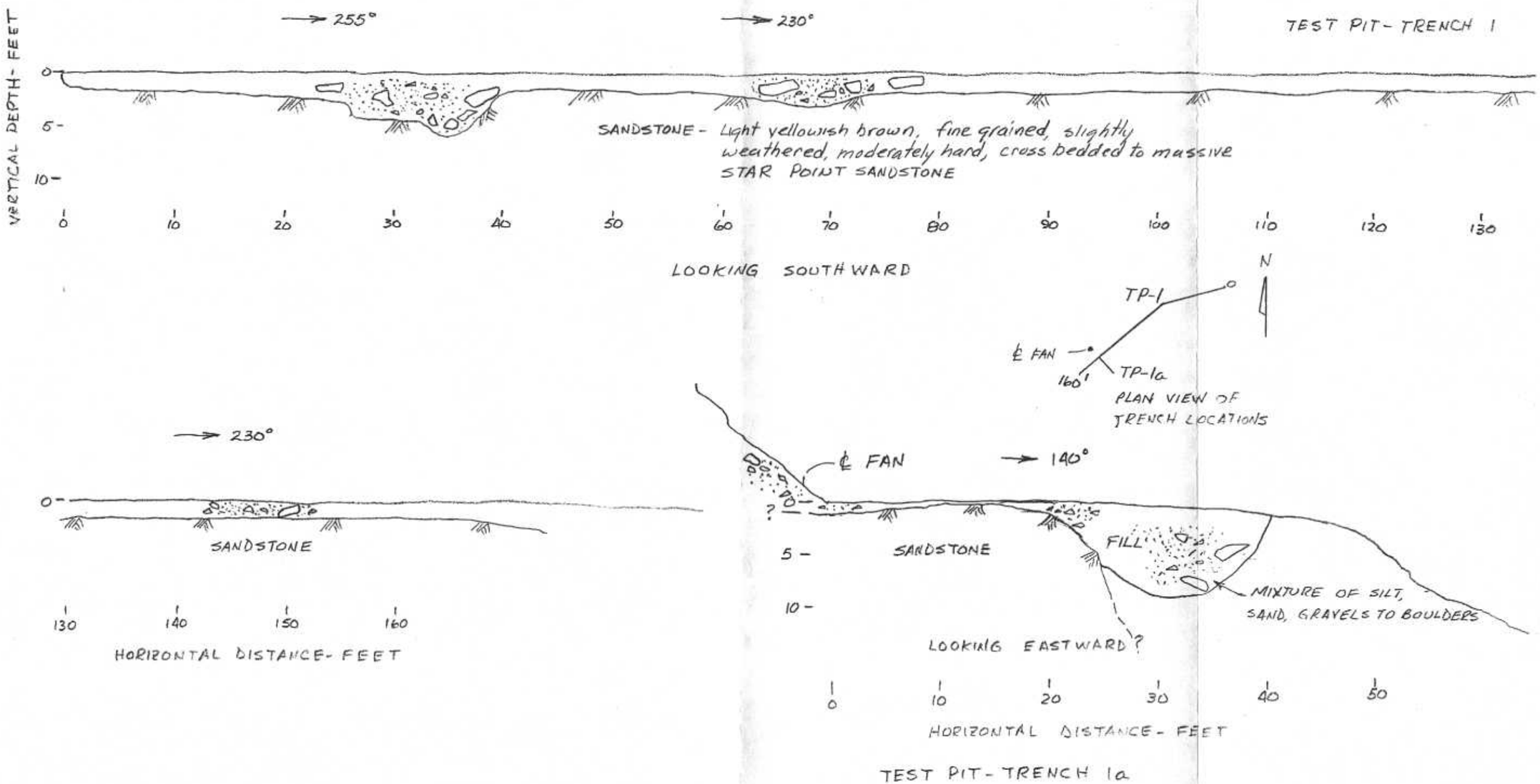
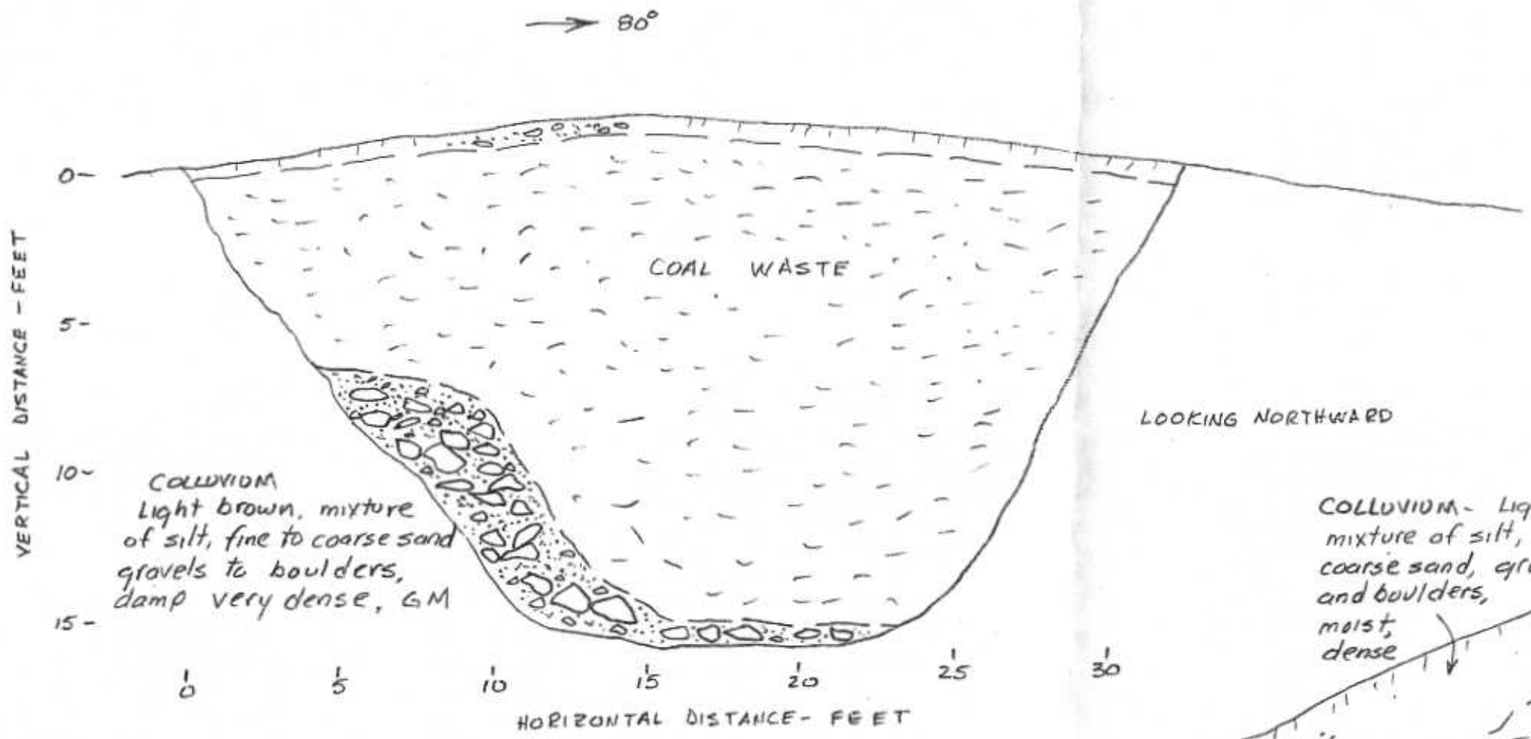


FIGURE A-16
LOG OF TEST TRENCHES

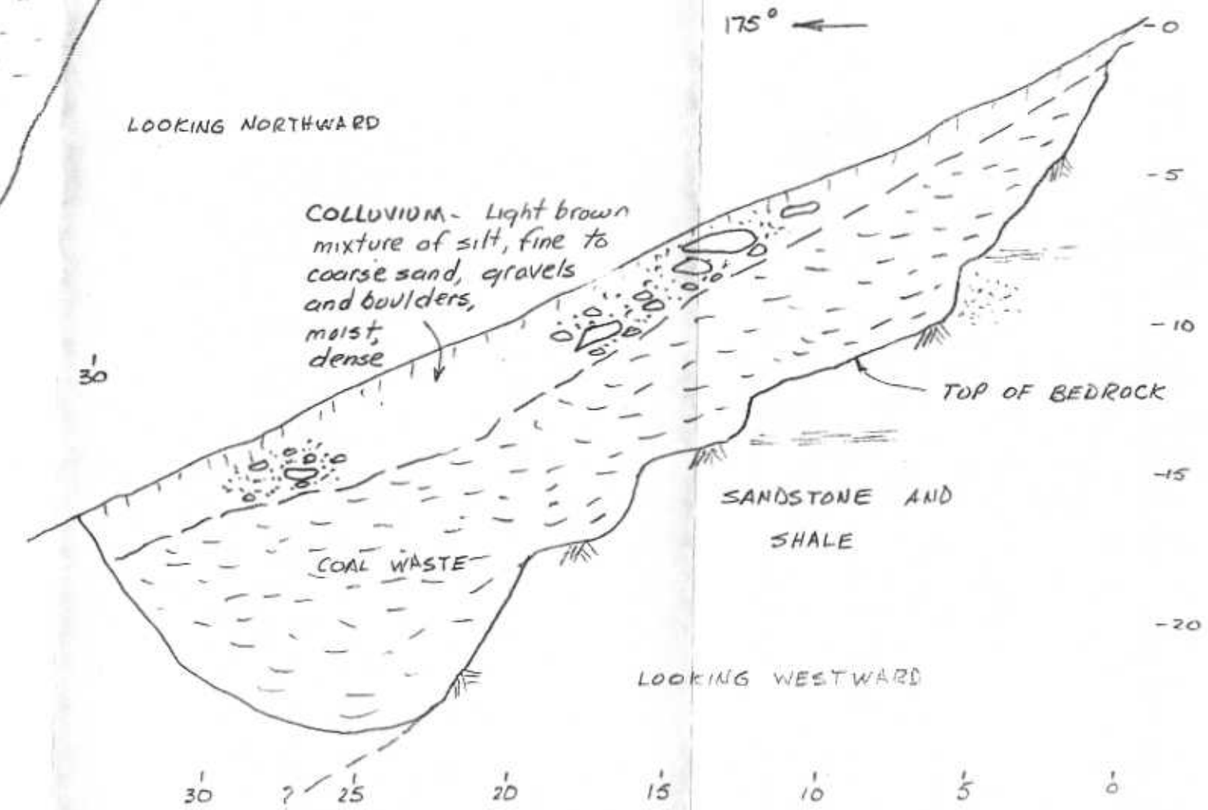
amec

DATE
CHECKED BY
DATE
BY
FILE NO.
N117726

ENERGY WEST MINING COMPANY
JOB NO. 3-817-004643



TEST PIT - TRENCH 8



TEST PIT - TRENCH 15

FIGURE A-17
LOG OF TEST TRENCHES

amec

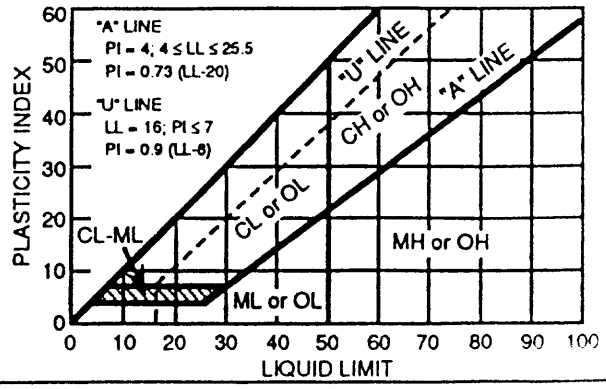
UNIFIED SOIL CLASSIFICATION SYSTEM

Soils are visually classified for engineering purposes by the Unified Soil Classification System. Grain-size analyses and Atterberg Limits tests often are performed on selected samples to aid in classification. The classification system is briefly outlined on this chart. Graphic symbols are used on boring logs presented in this report. For a more detailed description of the system, see "Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)" ASTM Designation: 2488-84 and "Standard Test Method for Classification of Soils for Engineering Purposes" ASTM Designation: 2487-85.

MAJOR DIVISIONS				GRAPHIC SYMBOL	GROUP SYMBOL	TYPICAL NAMES
COARSE-GRAINED SOILS Less than 50% passes No. 200 sieve)	GRAVELS (50% or less of coarse fraction passes No. 4 sieve)	CLEAN GRAVELS (Less than 5% passes No. 200 sieve)			GW	Well graded gravels, gravel-sand mixtures, or sand-gravel-cobble mixtures
					GP	Poorly graded gravels, gravel-sand mixtures, or sand-gravel-cobble mixtures
		GRAVELS WITH FINES (More than 12% passes No. 200 sieve)	Limits plot below "A" line & hatched zone on plasticity chart		GM	Silty gravels, gravel-sand-silt mixtures
			Limits plot above "A" line & hatched zone on plasticity chart		GC	Clayey gravels, gravel-sand-clay mixtures
	SANDS (50% or more of coarse fraction passes No. 4 sieve)	CLEAN SANDS (Less than 5% passes No. 200 sieve)			SW	Well graded sands, gravelly sands
					SP	Poorly graded sands, gravelly sands
		SANDS WITH FINES (More than 12% passes No. 200 sieve)	Limits plot below "A" line & hatched zone on plasticity chart		SM	Silty sands, sand-silt mixtures
			Limits plot above "A" line & hatched zone on plasticity chart		SC	Clayey sands, sand-clay mixtures
FINE-GRAINED SOILS (50% or more passes No. 200 sieve)	SILTS Limits plot below "A" line & hatched zone on plasticity chart	SILTS OF LOW PLASTICITY (Liquid Limit less than 50)			ML	Inorganic silts, clayey silts of low to medium plasticity
		SILTS OF HIGH PLASTICITY (Liquid Limit 50 or more)			MH	Inorganic silts, micaceous or diatomaceous silty soils, elastic silts
	CLAYS Limits plot above "A" line & hatched zone on plasticity chart	CLAYS OF LOW PLASTICITY (Liquid Limit less than 50)			CL	Inorganic clays of low to medium plasticity, gravelly, sandy, and silty clays
		CLAYS OF HIGH PLASTICITY (Liquid Limit 50 or more)			CH	Inorganic clays of high plasticity, fat clays, sandy clays of high plasticity
	ORGANIC SILTS AND CLAYS	ORGANIC SILTS AND CLAYS OF LOW PLASTICITY (Liquid Limit less than 50)			OL	Organic silts and clays of low to medium plasticity, sandy organic silts and clays
		ORGANIC SILTS AND CLAYS OF HIGH PLASTICITY (Liquid Limit 50 or more)			OH	Organic silts and clays of high plasticity, sandy organic silts and clays
ORGANIC SOILS		PRIMARILY ORGANIC MATTER (dark in color and organic odor)			PT	Peat

NOTE: Coarse-grained soils with between 5% and 12% passing the No. 200 sieve and fine-grained soils with limits plotting in the hatched zone on the plasticity chart have dual classifications.

PLASTICITY CHART



DEFINITION OF SOIL FRACTIONS

SOIL COMPONENT	PARTICLE SIZE RANGE
Boulders	Above 12 in.
Cobbles	12 in. to 3 in.
Gravel	3 in. to No. 4 sieve
Coarse gravel	3 in. to 3/4 in.
Fine gravel	3/4 in. to No. 4 sieve
Sand	No. 4 to No. 200 sieve
Coarse sand	No. 4 to No. 10 sieve
Medium sand	No. 10 to No. 40 sieve
Fine sand	No. 40 to No. 200 sieve
Fines (silt and clay)	Less than No. 200 sieve

FIGURE A-18

amec

APPENDIX B

GEOPHYSICAL INVESTIGATION – DECEMBER 2003

APPENDIX B
GEOPHYSICAL INVESTIGATION – DECEMBER 2003

LGS Geophysics, Inc. conducted six seismic refraction lines at Site 1 in December 2003. The approximate locations of the seismic lines are shown on Figure 2. The results of the geophysical investigation are summarized in the attached report.

RESULTS OF SEISMIC REFRACTION INVESTIGATIONS AT THE PROPOSED DEER CREEK/RILDA CANYON SURFACE FACILITIES, EMERY COUNTY, UTAH

Prepared For: AMEC Earth & Environmental
Salt Lake City, Utah

Prepared By: LGS Geophysics, Inc.
Salt Lake City, Utah

January 2004

Introduction

This report summarizes the results of seismic refraction investigations conducted at various sites for the proposed Deer Creek Mine/ Rilda Canyon surface facilities. The purpose of the investigations was to determine the approximate depths to bedrock at sites selected by the client. A site map was provided to us by the client which presented the proposed structure footprints, site topography and areas of previous mine reclamation. Compressional seismic velocites, as used in this survey, can be useful in providing a qualitative esitmate of the overburden densities and bedrock quality, provided the overburden material and bedrock types can be reliably inferred.

Site Description

The site is located within two miles from the mouth of Rilda Canyon, Emery County, Utah. The seismic lines were located on the north wall of the canyon with the exception of Seismic Line 4 which was located in the base of the canyon. Bedding attitudes of the thin bedded to massive sandstones outcrops observed throughout the work area were essentially horizontal. The seismic lines were located on mine reclamation fill with the exception of Seismic Line 4, located on stream alluvium and side canyon alluvial fan deposits and the upper ends of Lines 1 and 6, both of which were located on undisturbed slope wash.

Field Investigations

Field investigations were conducted December 2003, and consisted of completing six seismic refraction survey lines at the areas shown on Figure 1 of this report. Both ends of each line were staked with a flagged lath on completion of the line to facilitate subsequent surveying of their locations. Each seismic line consisted of 12 geophones, spaced at either 10 foot (Line 1), 15 foot (Lines 3, 5 and 6) or 25 foot intervals (Lines 2 and 4) in a straight line on the ground surface. Near end shot points for the seismic lines were 10 ft. from the nearest geophone. Each seismic line was reversed, that is, data for each line was obtained at both ends of each line. Six shot points were used at each of the lines to obtain redundancy of the data. Approximate relative elevations were obtained between all shot points and geophone stations by hand level to establish a datum for the subsequent seismic data reduction. The geophones were placed in small diameter holes beneath the generally loose surface soil and/or root zone in order to obtain solid coupling of the phone with the more firm, underlying soil.

The seismic data was digitized and saved on magnetic media in the field for subsequent processing in the office.

Equipment Used

A Geometrics S-12, 12 channel, signal enhancement seismograph, with an on-board computer and 8.5 Hz geophones, were used in the data collection. The signal enhancement feature enabled the use of a 16 lb. sledge hammer, striking a steel plate on the ground surface, as the energy source.

Office Procedures

Data reduction, analyses and presentations were computer assisted. Delay times and an iterative ray tracing procedure were used in determining the depths to the subsurface layering and the bedrock topography. The depths thus computed were verified by a second analytical procedure which was based on both the critical distance and the seismic velocities obtained from the time-distance plots of the seismic field data.

The data was then presented as computer printed cross sections of the subsurface immediately beneath each seismic line, showing the ground surface, contacts between the layers encountered and the bedrock topography, together with their respective, approximate elevations.

Results

Survey results are presented on Figures 2 to 4 as interpreted cross sections of the subsurface beneath each seismic line, with the reference elevations and approximate depths of the layers shown. A thin surface layer of weathered and organic soils, with a very low seismic velocity, typically overlies many areas. However, at the Rilda Canyon sites this layer was typically very thin to non-existent and was therefore not included on the cross sections of Figures 2 to 4. Each of the cross sections are thus presented as two layer cases, that is, a section of low to moderate velocity overburden over a high velocity layer interpreted as bedrock.

The density of a material is an important factor in determining the seismic velocity of that material. Overburden velocities in the range of 1900 to 2200 ft/sec indicate generally medium to dense material (for generally granular material). This range of velocities were obtained for all of the sites covered by mine reclamation fill, indicating a generally moderate to well compacted material. Lower overburden velocities were encountered at the east and west ends of Line 5 (1200 ft/sec) which consisted of loose slope wash and the alluvial deposits at Line 4 (1500 ft/sec).

Seismic velocities of the bedrock were quite variable, ranging from 4800 ft/sec (most of Line 1) to 11,400 ft/sec underlying Line 2. The low seismic velocity of the most of Line 1 may be due to the

seismic energy crossing common, open or soil filled joints in the the bedrock which are oriented roughly perpendicular to the seismic line orientation. An alternate explanation is that this low velocity may be due to the energy crossing weathered, thin to medium spaced bedding planes of the horizontally bedded bedrock visible in the general area. No bedrock outcrops were observed in the immediate vicinity of the seismic line. However, an extensive area of large boulder size sandstone rock was noted just above the north end of the line.

Limitations

Contacts between velocity layers are commonly gradational and are thus considered to be approximate. The terms overburden, weathered rock , weathered, fractured rock, bedrock, etc., are inferred, based on their seismic velocities, and are interpretative only.

We appreciate the opportunity to provide this information for you. Please contact us if there are any questions or if you need additional information.

Respectfully
LGS Geophysics Inc.

Lamont Sorenson
President

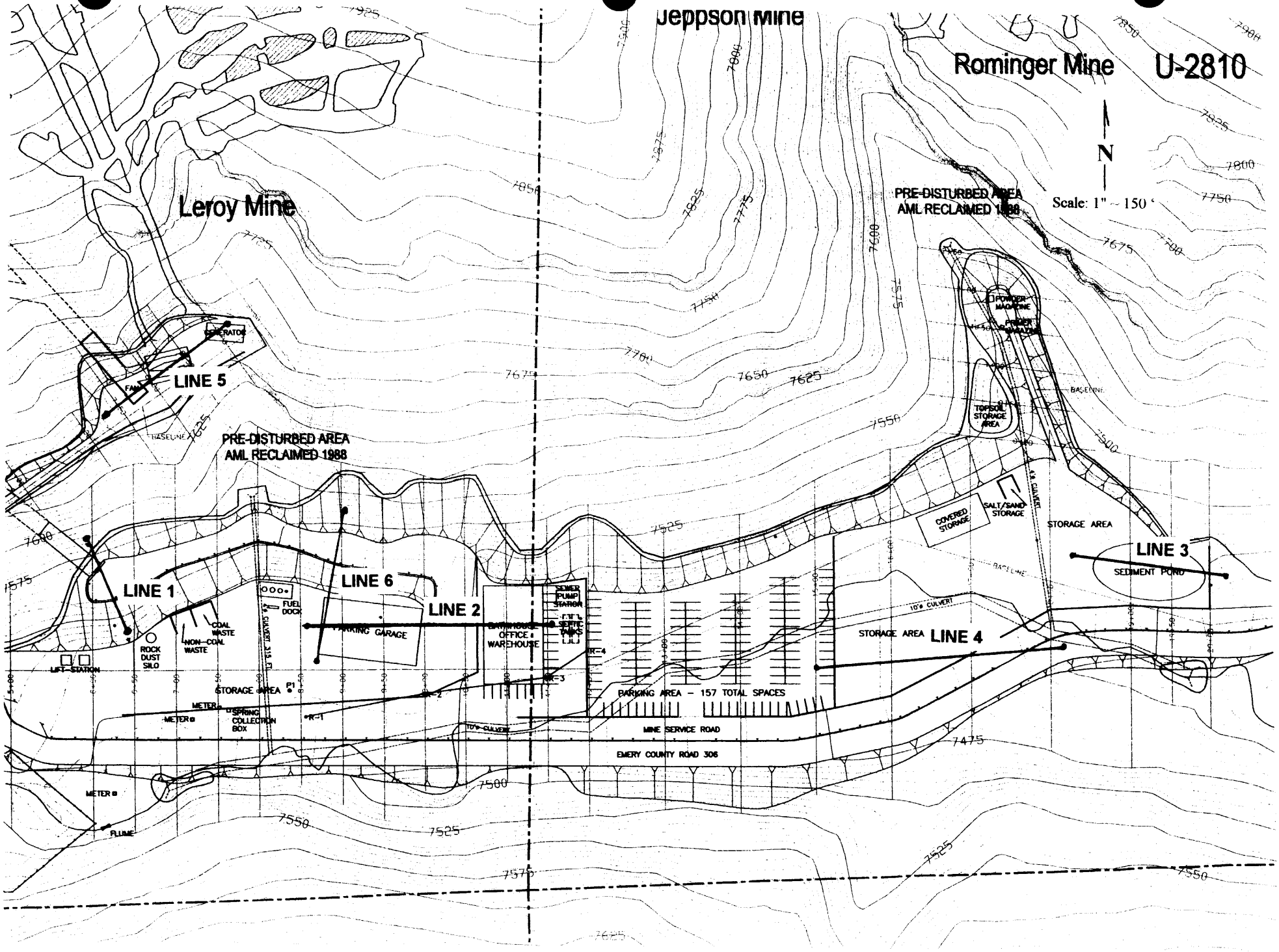
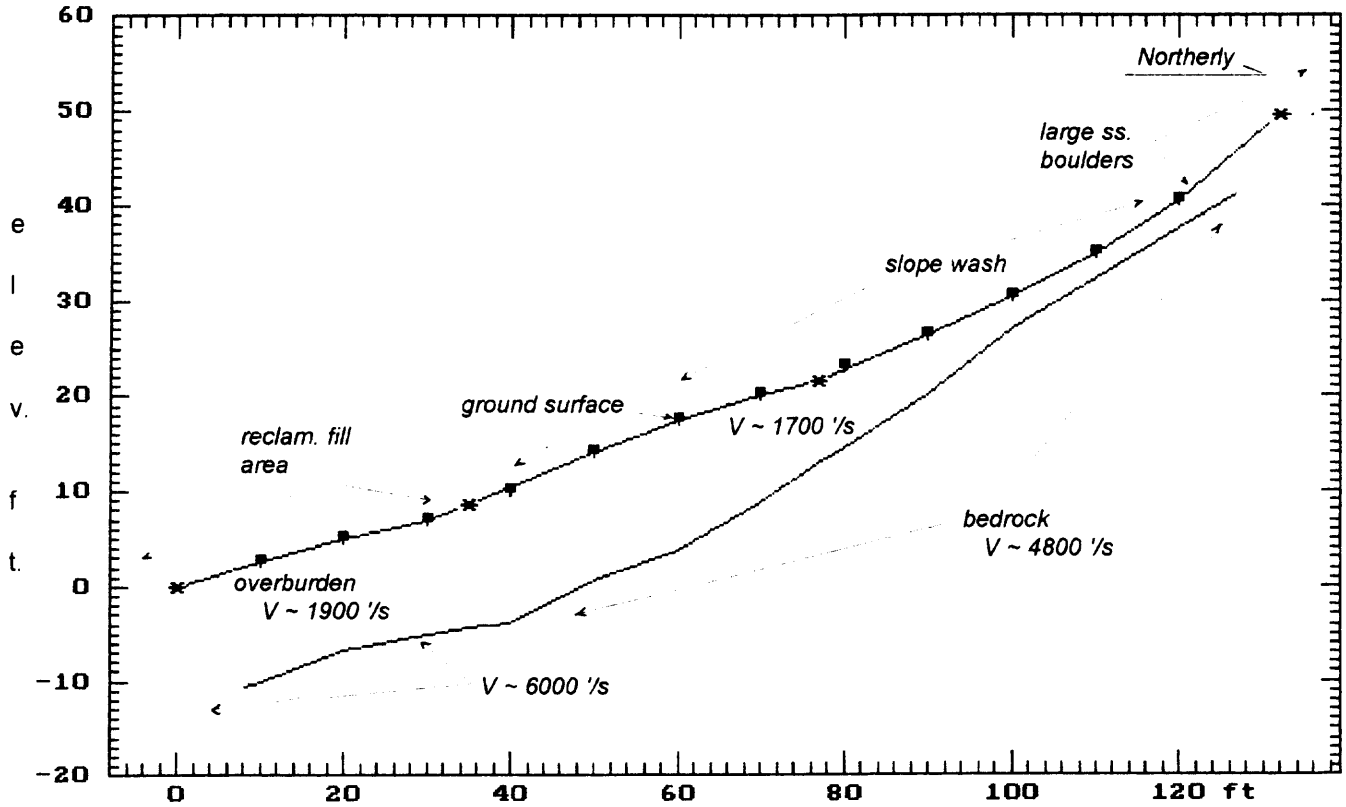
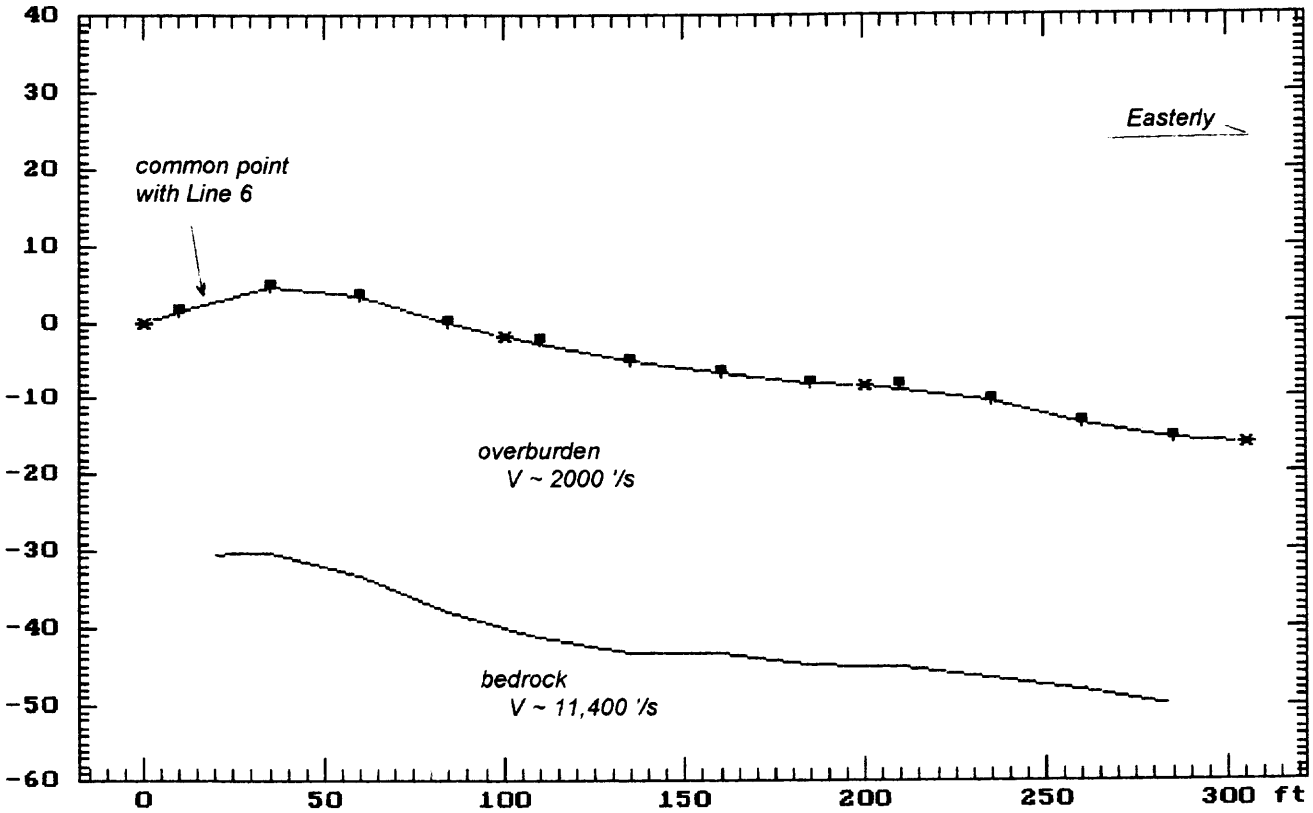

Jeppson Mine
Rominger Mine
U-2810
N
Scale: 1" = 150 '
Leroy Mine
PRE-DISTURBED AREA
AML RECLAIMED 1988
PRE-DISTURBED AREA
AML RECLAIMED 1988
GENERATOR
FAN
LINE 5
BASELINE
LINE 1
LINE 6
LINE 2
LINE 3
LINE 4
SEDIMENT POND
POWDER MAGAZINE
POWDER MAGAZINE
TOPSOIL STORAGE AREA
COVERED STORAGE
SALT/SAND STORAGE
STORAGE AREA
10'ø CULVERT
4'ø CULVERT
FUEL DOCK
COAL WASTE
NON-COAL WASTE
ROCK DUST SILO
LIFT STATION
CULVERT 315 FT
PARKING GARAGE
SEWER PUMP STATION
SEPTIC TANKS
BATHHOUSE OFFICE WAREHOUSE
STORAGE AREA
P1
R-1
R-2
R-3
R-4
METER
SPRING COLLECTION BOX
PARKING AREA - 157 TOTAL SPACES
MINE SERVICE ROAD
EMERY COUNTY ROAD 306
FLUME

FIGURE 1

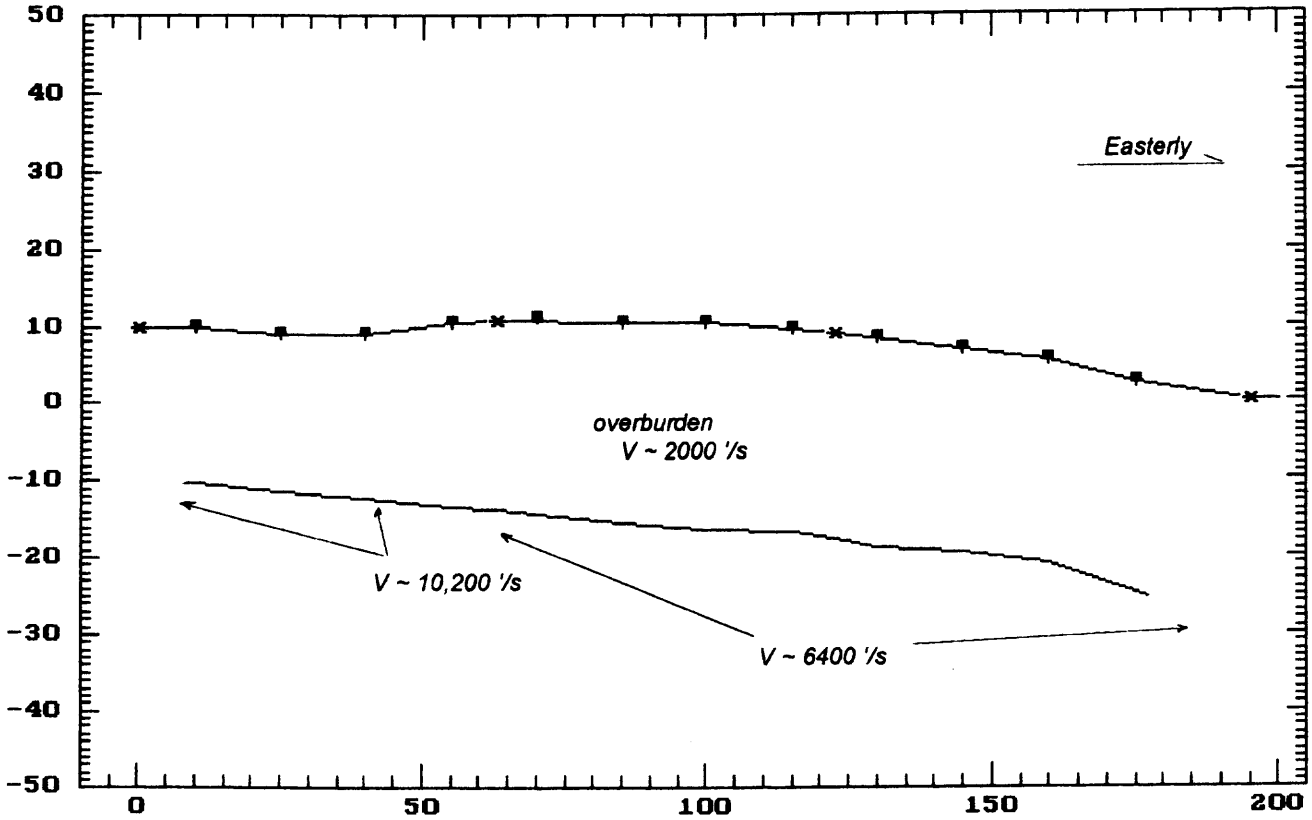


SEISMIC LINE 1
INTERPRETED SUBSURFACE
CROSS SECTION

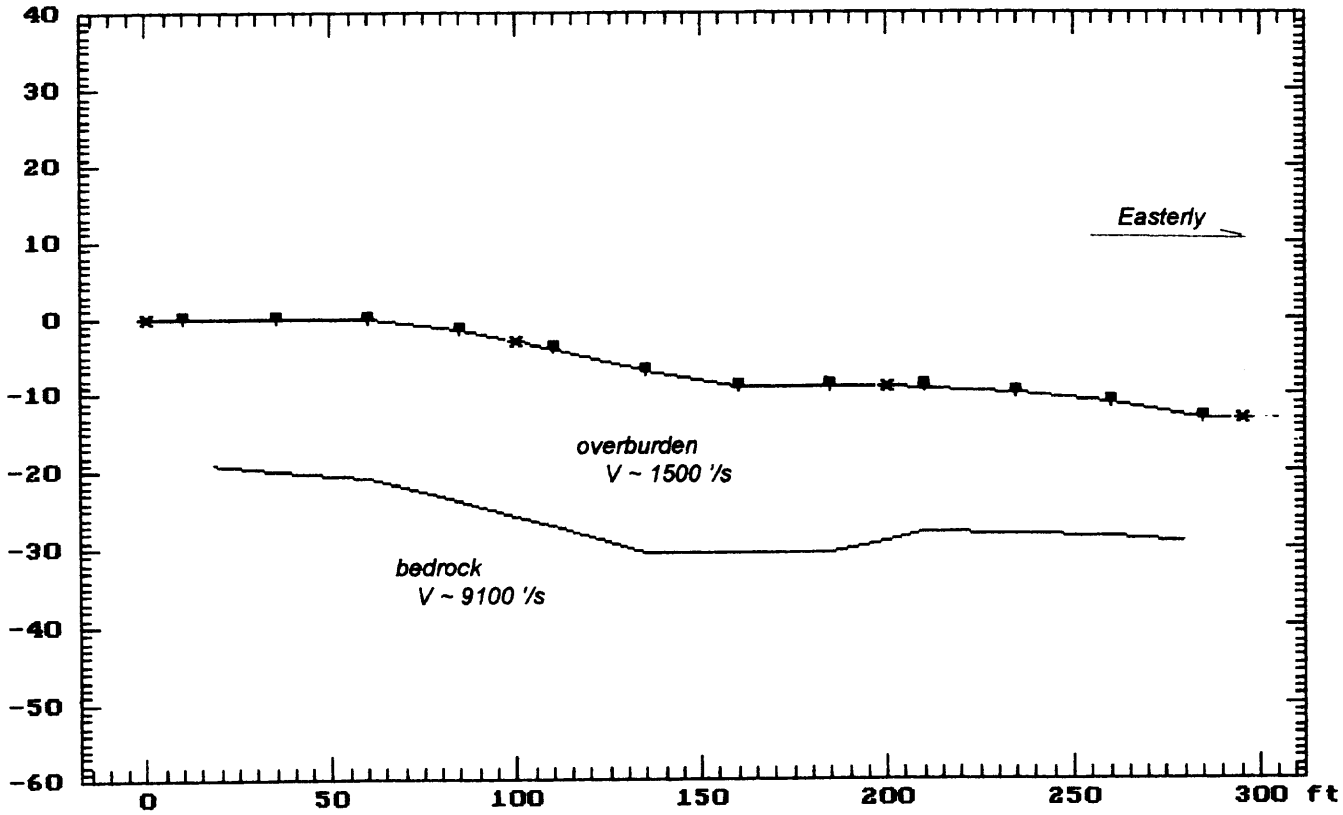


SEISMIC LINE 2
INTERPRETED SUBSURFACE
CROSS SECTION

FIGURE 2

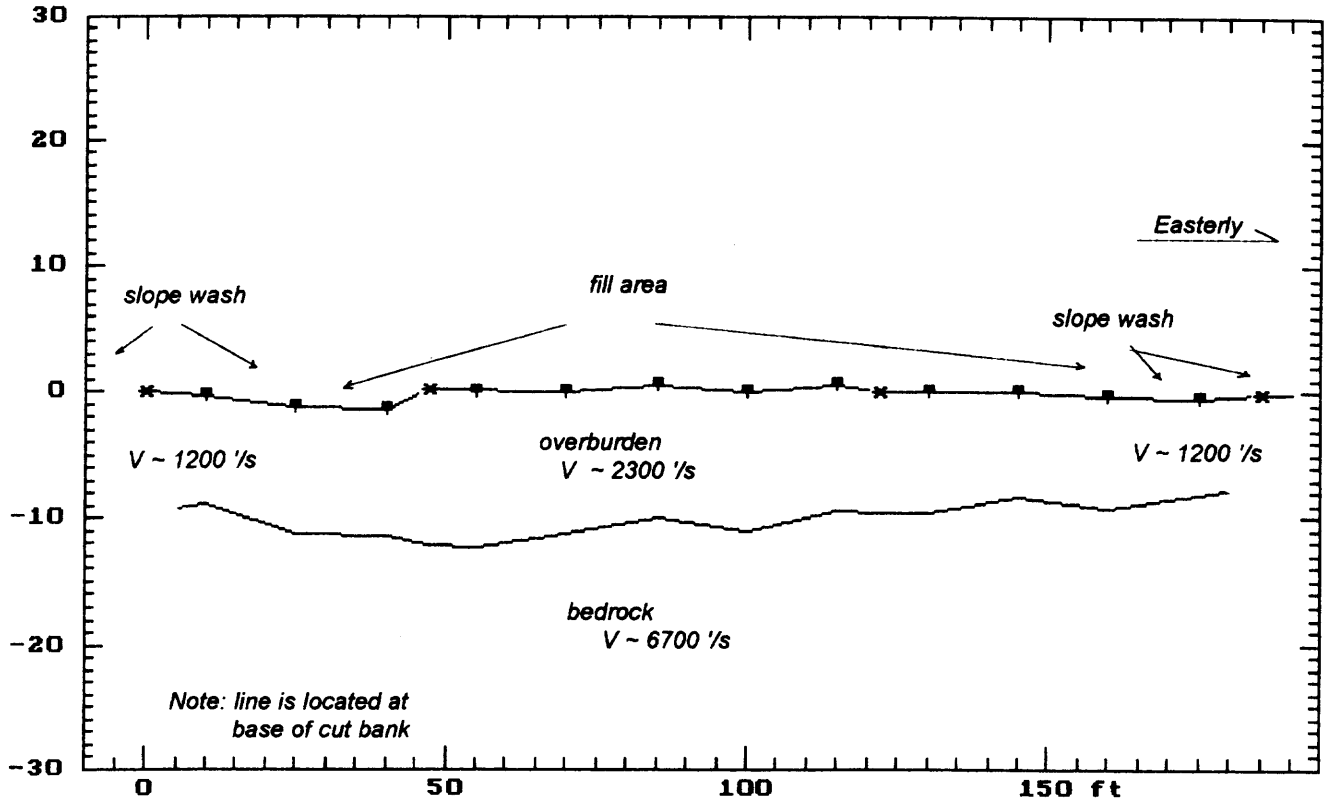


SEISMIC LINE 3
INTERPRETED SUBSURFACE
CROSS SECTION

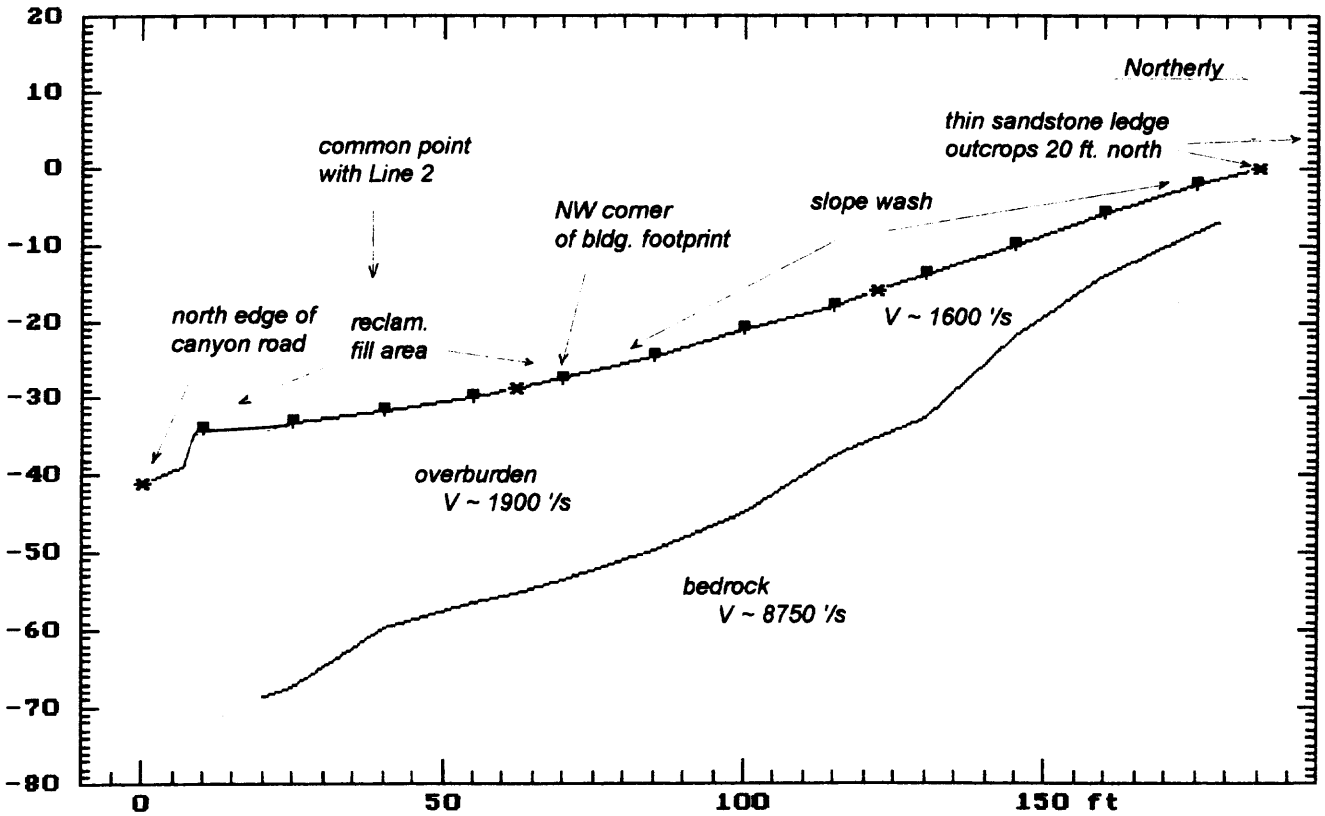


SEISMIC LINE 4
INTERPRETED SUBSURFACE
CROSS SECTION

FIGURE 3



SEISMIC LINE 5
INTERPRETED SUBSURFACE
CROSS SECTION



SEISMIC LINE 6
INTERPRETED SUBSURFACE
CROSS SECTION

FIGURE 4

APPENDIX C

GEOPHYSICAL INVESTIGATION – JULY 2004

APPENDIX C
GEOPHYSICAL INVESTIGATION – JULY 2004

LGS Geophysics, Inc. conducted four seismic refraction lines at Site 2 in July 2004. The approximate locations of the seismic lines are shown on Figure 3. The results of the geophysical investigation are summarized in the attached report.

RESULTS OF SEISMIC REFRACTION INVESTIGATIONS AT THE PROPOSED DEER CREEK/RILDA CANYON SURFACE FACILITIES, EMERY COUNTY, UTAH SECOND SURVEY

Prepared For: AMEC Earth & Environmental
Salt Lake City, Utah

Prepared By: LGS Geophysics, Inc.
Salt Lake City, Utah

July 2004

Introduction

This report presents the results of seismic refraction investigations conducted at three sites for proposed Deer Creek Mine/ Rilda Canyon surface facilities and a fourth site, located at a spring collection study area. The purpose of the investigations was to determine the approximate depths to bedrock at sites selected by the client. A site map was provided to us by the client which presented the proposed structure footprints, site topography and areas of previous mine reclamation.

Site Description

The site is located within two and one-half miles from the mouth of Rilda Canyon, Emery County, Utah. The seismic lines at the surface facility sites were located on the north wall of the canyon. The site at the spring collection study area was located at the mouth of a small drainage. Bedrock outcrops in the immediate area of each of the lines consisted of near vertical 10 to 20 ft. high cliffs of massive, buff to white sandstone with horizontal bedding. The seismic lines were located on colluvium (slope wash), with the exception of Seismic Line 1 which was located on stream alluvium.

Field Investigations

Field investigations were conducted in July 2004, and consisted of completing four seismic refraction survey lines at the areas shown on Figure 1 of this report. Both ends of each line were staked with a flagged lath on completion of the line to facilitate subsequent surveying of their locations. Each seismic line consisted of 12 geophones, spaced at 15 foot intervals in a straight line on the ground surface. Near end shot points for the seismic lines were 10 ft. from the nearest geophone. Each seismic line was reversed, that is, data for each line was obtained at both ends of each line. Four to six shot points were used at each of the lines to obtain redundancy of the data. These included extended shot points located up to 50 ft. beyond the lower end of each line. Very steep topography precluded extended shot points beyond the upper ends of the lines. Approximate relative elevations were obtained between all shot points and geophone stations by hand level to establish a datum for the subsequent seismic data reduction. The geophones were placed in small diameter holes beneath the generally loose surface soil and/or root zone in order to obtain solid coupling of the phone with the more firm, underlying soil.

The seismic data was digitized and saved on magnetic media in the field for subsequent processing in the office.

Equipment Used

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8.5 Hz geophones, were used in the data collection. The signal enhancement feature enabled the use of a 16 lb. sledge hammer, striking a steel plate on the ground surface, as the energy source.

Office Procedures

Data reduction, analyses and presentations were computer assisted. Delay times and an iterative ray tracing procedure were used in determining the depths to the subsurface layering and the bedrock topography. The depths thus computed were verified by a second analytical procedure which was based on both the critical distance and the seismic velocities obtained from the time-distance plots of the seismic field data.

The data was then presented as computer printed cross sections of the subsurface immediately beneath each seismic line, showing the ground surface, contacts between the layers encountered and the bedrock topography, together with their respective, approximate elevations.

Results

Survey results are presented on Figures 2 and 3 as interpreted cross sections of the subsurface beneath each seismic line, with the reference elevations and approximate depths of the layers shown and are self-explanatory. The density of a material is an important factor in determining the seismic velocity of that material. Overburden velocities in the range of those encountered (i.e., 1500 to 1700 ft/sec) indicate generally loose to medium dense material (for predominantly granular soils).

Seismic velocities of the bedrock were moderate, ranging from 7000 to 8400 ft/sec.

The presence of a water saturated zone was not indicated by the seismic data at the spring collection study area. However, a relatively thin saturated zone, say 5 ft. or so thick over bedrock, would not be detected by the seismic method under these specific site conditions.

Several conditions occur at the sites investigated that present difficulties in analysis and interpretation. These consist of 1) apparently abrupt, steep dropoffs in the underlying bedrock surface and , 2) locally steeply dipping bedrock surface. Item 1) is difficult to model accurately since the geometry of the seismic waves used in the refraction seismic method tends to have a smoothing effect on such features. Item 2) was difficult to model due a combination of Item 1) and to topographical limitations (very steep upper slopes on the upper ends and creek bottom on the lower ends) which limited the extent of extended shot points, required to more fully map the steeply dipping bedrock surface at the lower end of the lines. These limitations were recognized in our interpretations as presented on

Figures 2 and 3 and therefore we regard the interpretations as reasonably accurate depictions of the subsurface at the sites. However, for sites where the depth to bedrock is critical, we recommend that seismic line(s) located parallel to the ground surface slope be completed to confirm our interpretations.

Limitations

Contacts between velocity layers are commonly gradational and are thus considered to be approximate. The terms overburden, weathered rock , weathered, fractured rock, bedrock, etc., are inferred, based on their seismic velocities, and are interpretative only.

We appreciate the opportunity to provide this information for you. Please contact us if there are any questions or if you need additional information.

Respectfully
LGS Geophysics Inc.

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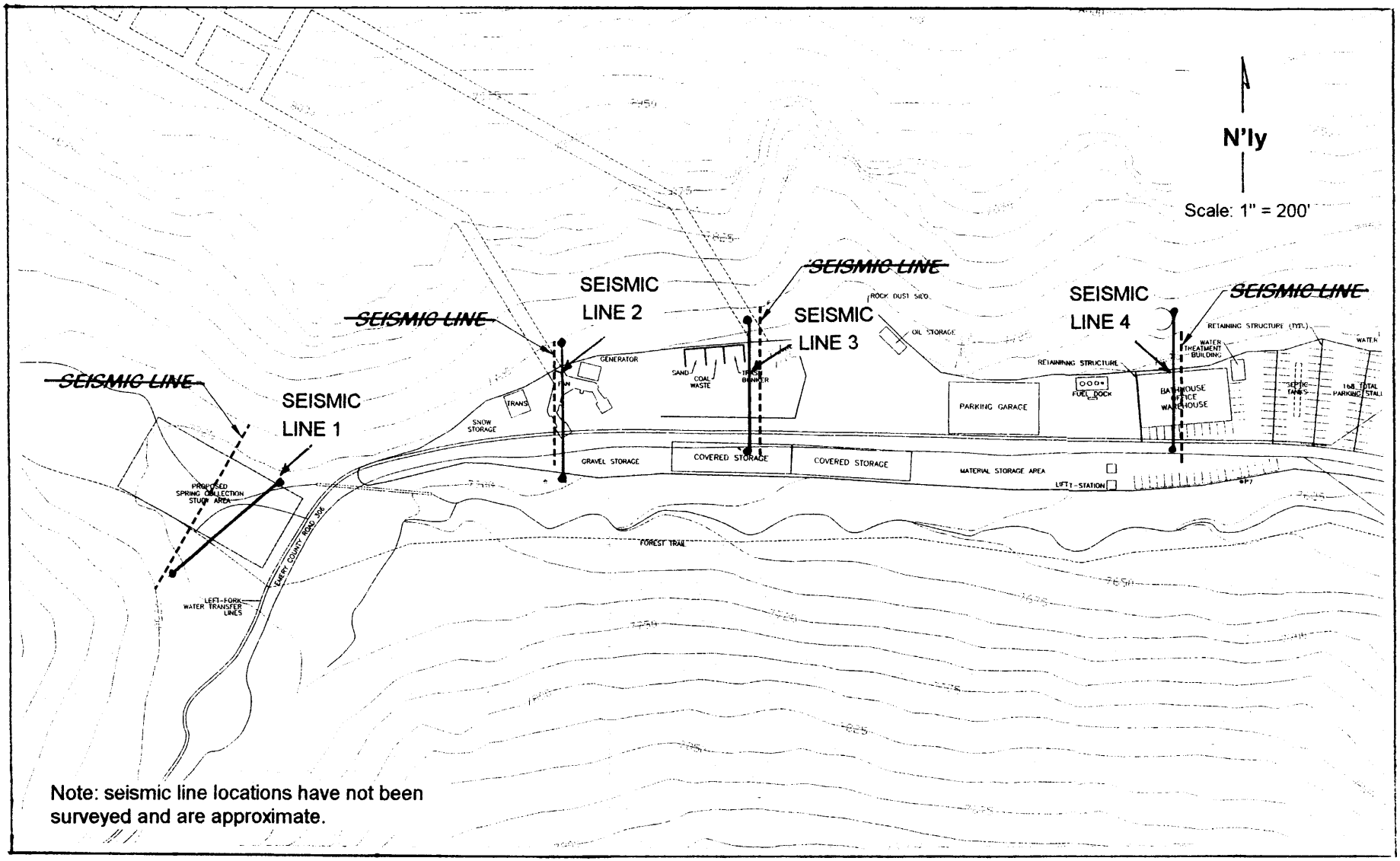
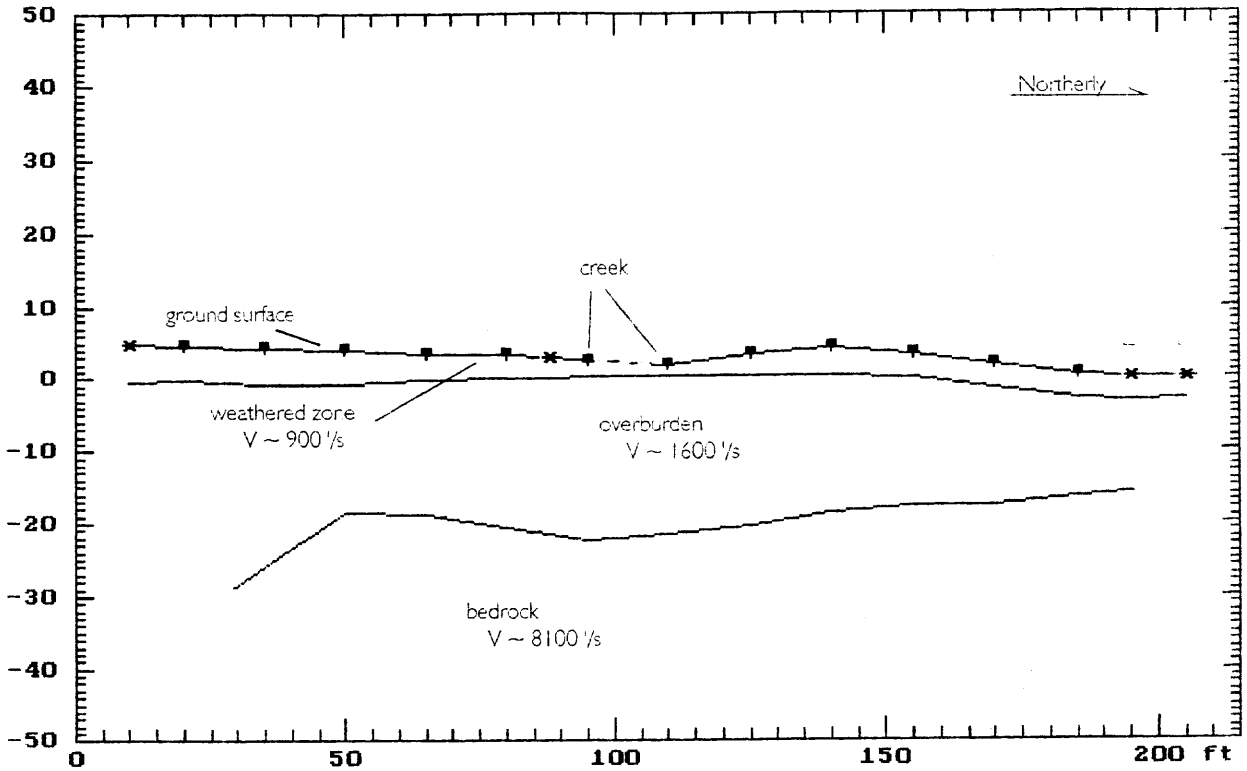
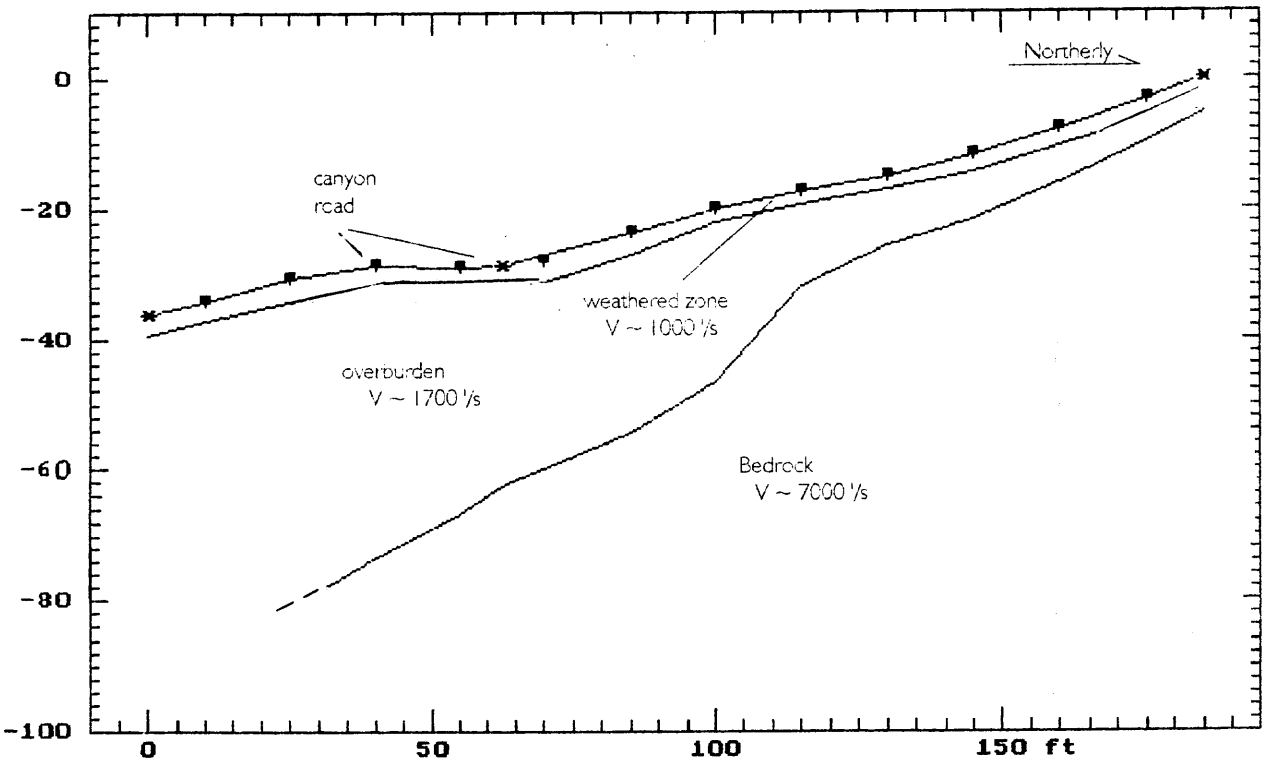


SITE MAP W/ SEISMIC LINE LOCATIONS

FIGURE 1

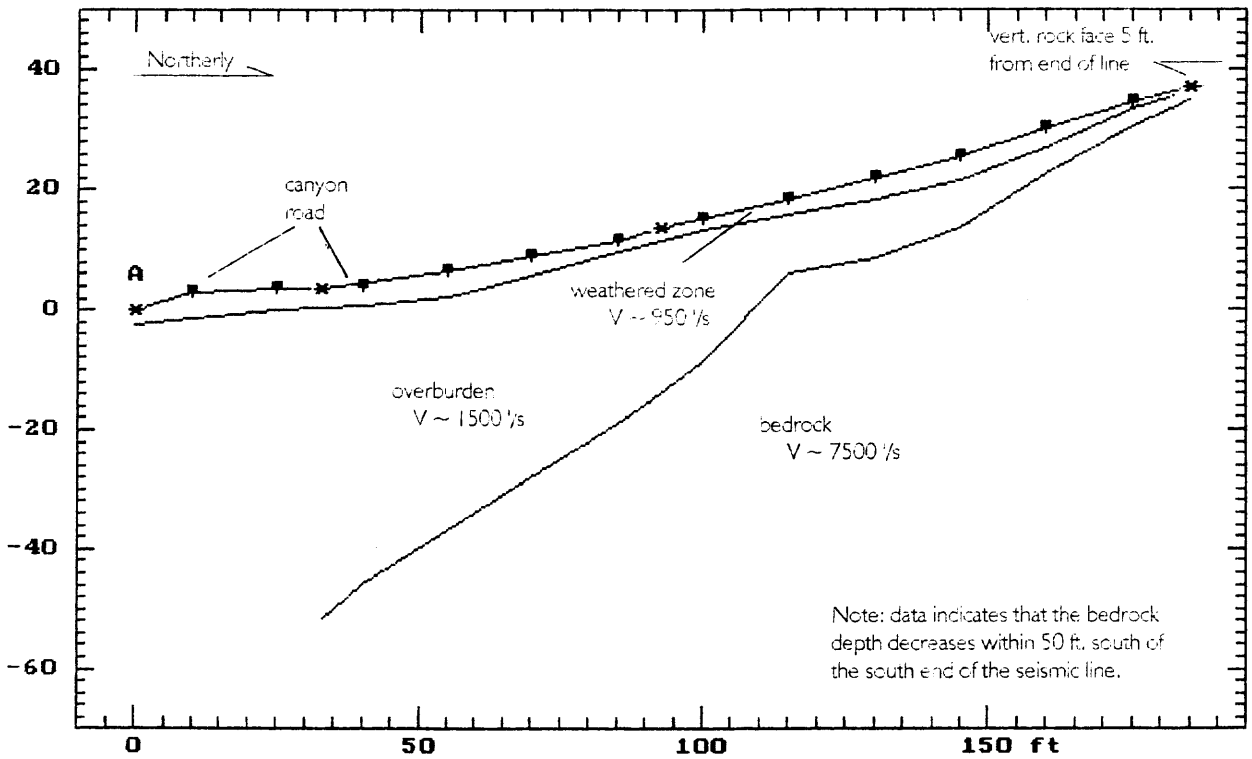


LINE 1 - INTERPRETED SUB - SURFACE CROSS SECTION

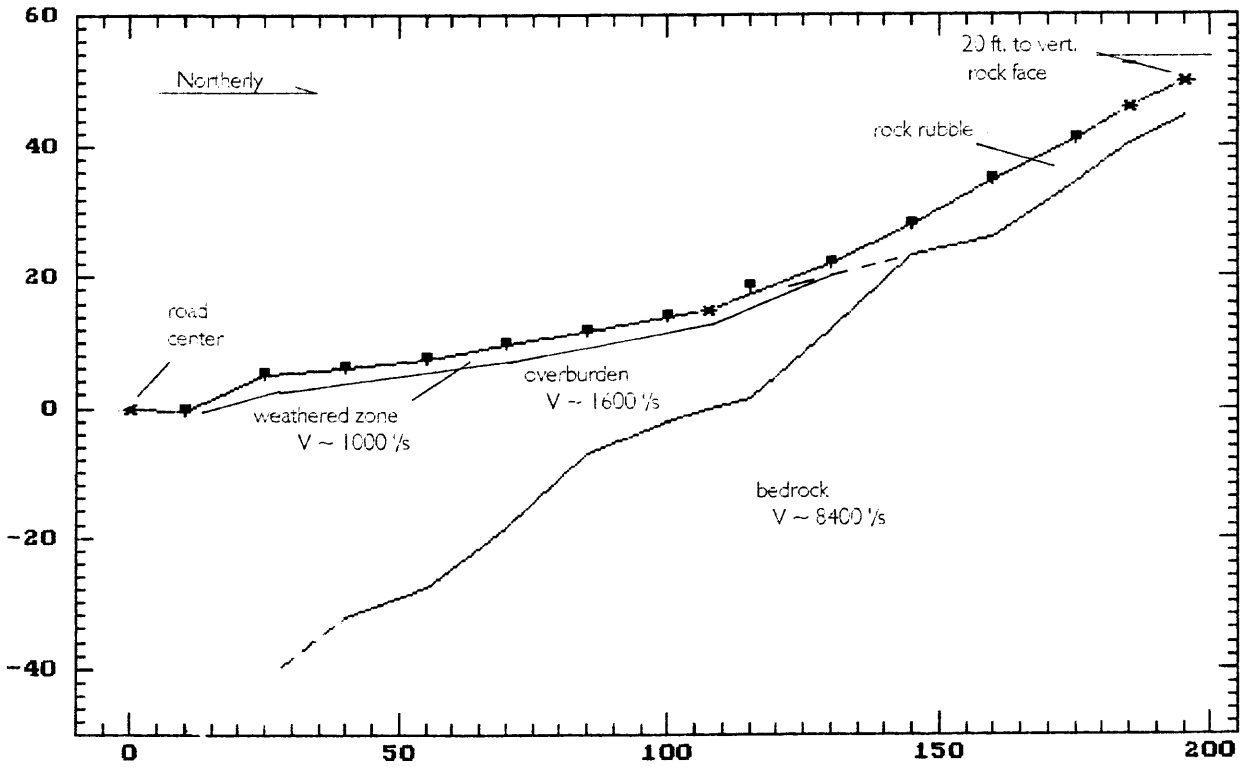


LINE 2 - INTERPRETED SUB-SURFACE CROSS SECTION

FIGURE 2



LINE 3 - INTERPRETED SUB-
SURFACE CROSS SECTION



LINE 4 - INTERPRETED SUB -
SURFACE CROSS SECTION

FIGURE 3

APPENDIX D

LABORATORY TESTING – SITE 1

APPENDIX D
LABORATORY TESTING – SITE 1

1. GENERAL

Laboratory tests were performed on representative samples of the soils encountered in the test pit and trench explorations at Site 1 to evaluate pertinent physical characteristics, aid in classifying the soils, and correlate other test data. The laboratory program included sample inspection to supplement AMEC's field soil descriptions, classification testing to determine natural moisture content and grain-size distribution, laboratory compaction testing to determine maximum dry density and optimum moisture content, and chemical testing for pH and soluble sulfates.

Due to the similarity of samples obtained across the site at various depths, individual samples were combined with similar samples into three composite samples for testing. The source samples of the composited samples are listed in the following table.

Composite Sample No.	Sample Source	Sample Depth (feet)
C-1	TP-4	3.0 to 4.0
	TP-5	0.0 to 2.0
	TP-7	0.0 to 2.0
C-2	TP-5	6.0 to 8.0
	TP-6	13.0 to 15.0
	TP-7	9.0 to 11.0
	TP-10	10.0 to 13.0
	TP-14	10.0 to 13.0
C-3	TP-2	5.0 to 7.0
	TP-3	3.0 to 4.0
	TP-4	9.0 to 11.0
	TP-4	13.0 to 15.0
	TP-6	2.0 to 4.0

Identification of the test procedures and summaries of selected test results are presented in the following sections of this appendix.

2. CLASSIFICATION TESTS

2.1 MOISTURE TESTS

Determination of natural moisture content was performed in general accordance with ASTM D-2216 test procedures. Natural moisture content, where determined, is presented

adjacent to the corresponding sample notations on the test pit and trench logs included in Appendix A.

2.2 GRAIN SIZE ANALYSES

Grain-size analyses were performed in general accordance with ASTM C-117, C-136, and D-1140 test procedures. Results from the grain-size analyses are summarized in the following table.

Sample No.	Sample Depth (ft)	Percent Passing by Weight					Unified Soil Classification System Group Symbol
		¾-inch	No. 4	No. 40	No. 100	No. 200	
C-1	--	83	68	55	37	27	SM
C-2	--	85	66	53	38	29	SM
C-3	--	81	65	53	38	29	SM
TP-11	3.0 to 6.0	86	73	58	38	26	SM

2.3 COMPACTION TESTS

Compaction tests were performed in general accordance with ASTM D1557 (modified Proctor) test procedures. The general results of the compaction tests are summarized in the following table.

Sample No.	Optimum Moisture Content (percent)	Maximum Dry Density (pcf)	Rock Corrected Maximum Dry Density (pcf)	Unified Soil Classification System Group Symbol
C-1	9.5	124.5	127.5	SM
C-2	9.0	130.5	132.9	SM
C-3	9.5	128.5	132.2	SM

2.4 PH AND SOLUBLE SULFATES TESTS

To determine if the site soils will react detrimentally with concrete, pH and soluble sulfates tests were performed on four representative samples of the site soils. The results of the tests are summarized in the table on the following page.

Boring No.	Sample Depth (ft)	Unified Soil Classification System Group Symbol	pH	Soluble Sulfates Content (Percent by weight)
C-1	--	SM	7.7	<0.0010
C-2	--	SM	8.0	0.0355
C-3	--	SM	8.1	<0.0010
TP-14	3.0 to 6.0	SM	8.3	<0.0010

The results of the pH testing indicate that the tested soils are mildly to moderately alkaline. The results of the soluble sulfates testing indicate that the tested soils contain negligible amounts of water-soluble sulfates. Based on the above values, the potential of the Site 1 soils to react detrimentally with concrete is considered to be negligible.

NOTES

R645-301-500 ENGINEERING SECTION

APPENDIX G

♦RILDA CANYON PORTAL FACILITIES SITE PHOTOS

R645-301-500 ENGINEERING SECTION

APPENDIX G

♦RILDA CANYON PORTAL FACILITIES SITE PHOTOS

♦PREVIOUSLY DISTURBED AREAS

Photo A:
Rominger Mine

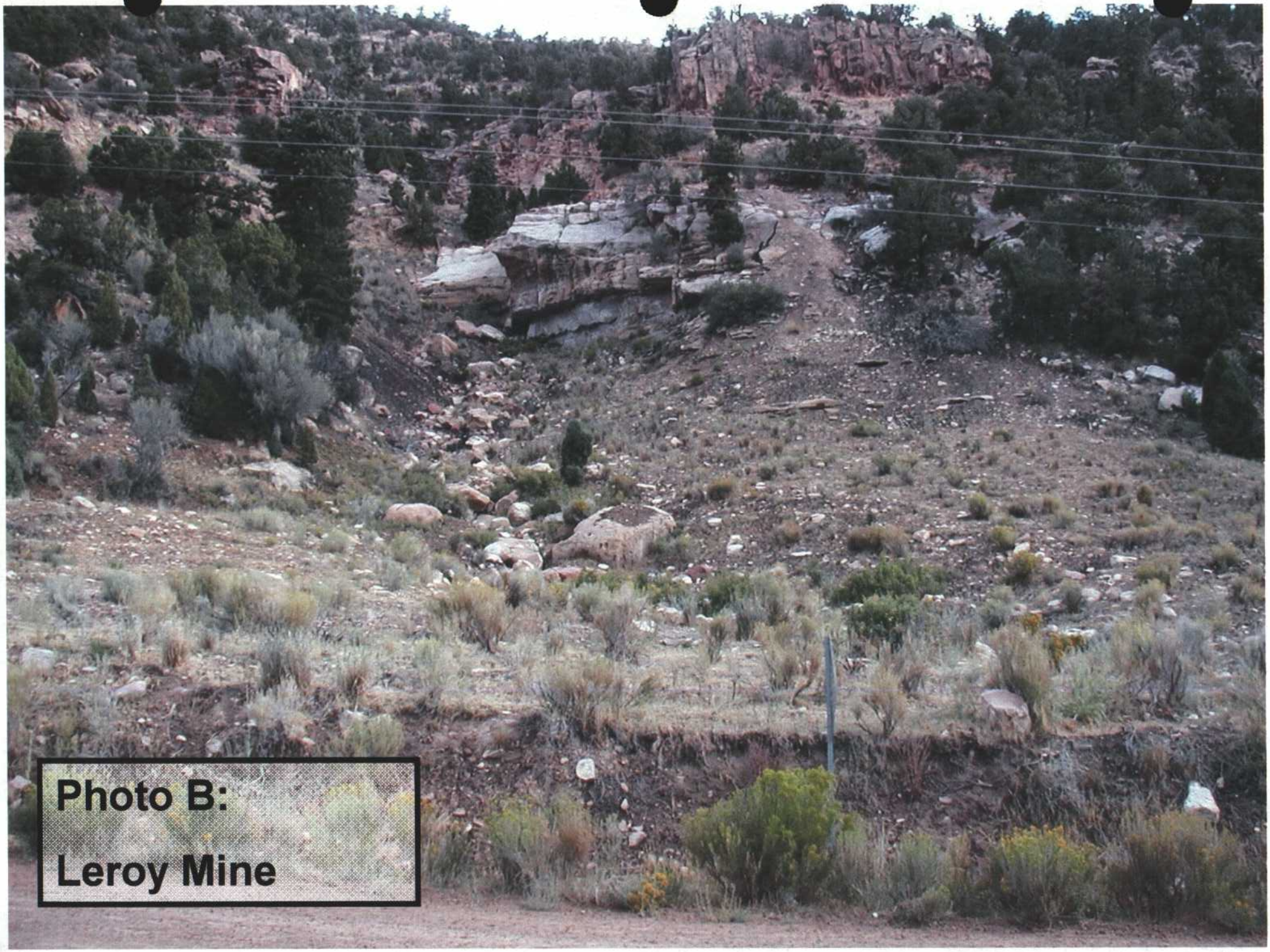


Photo B:
Leroy Mine

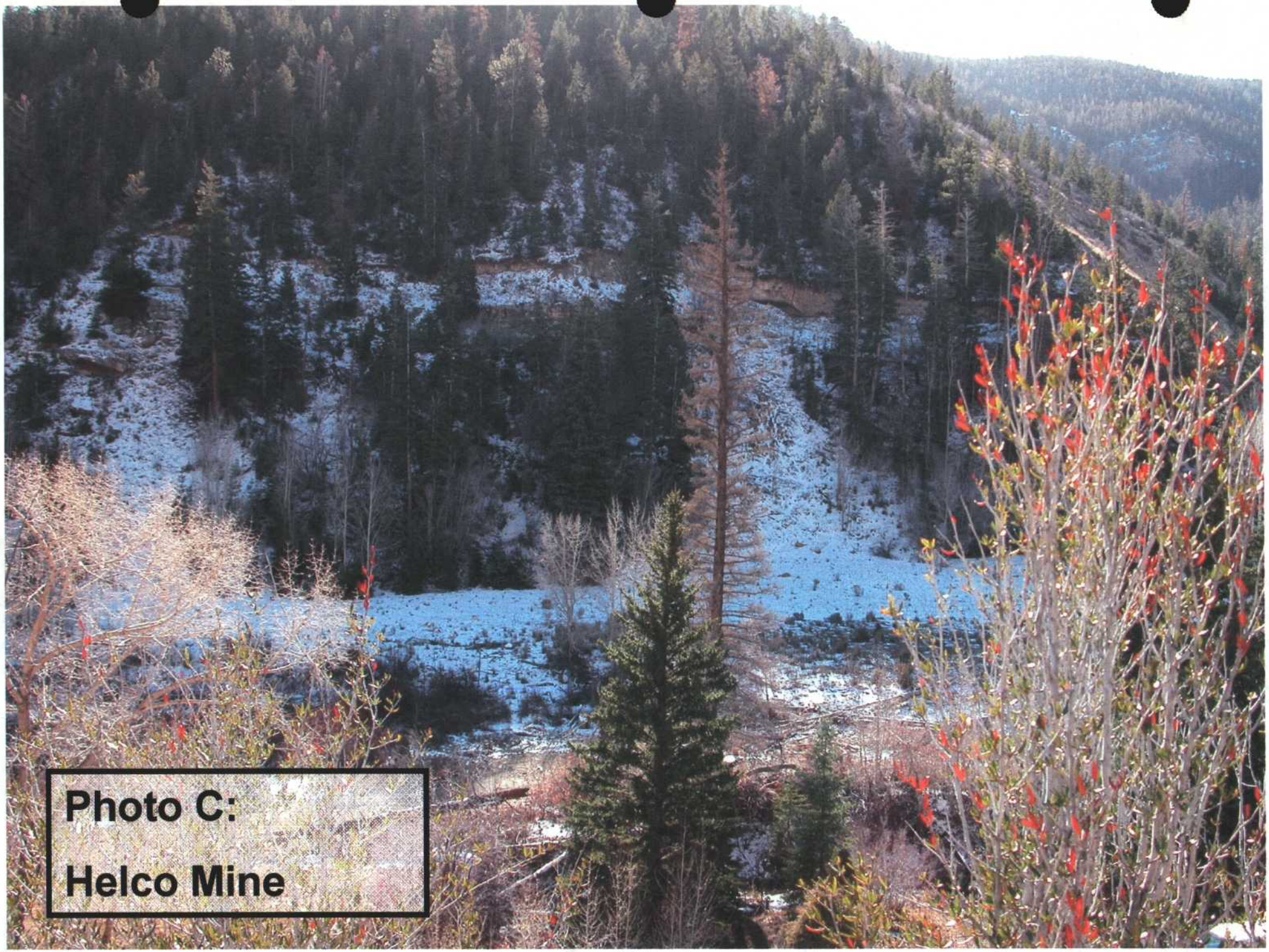


Photo C:
Helco Mine

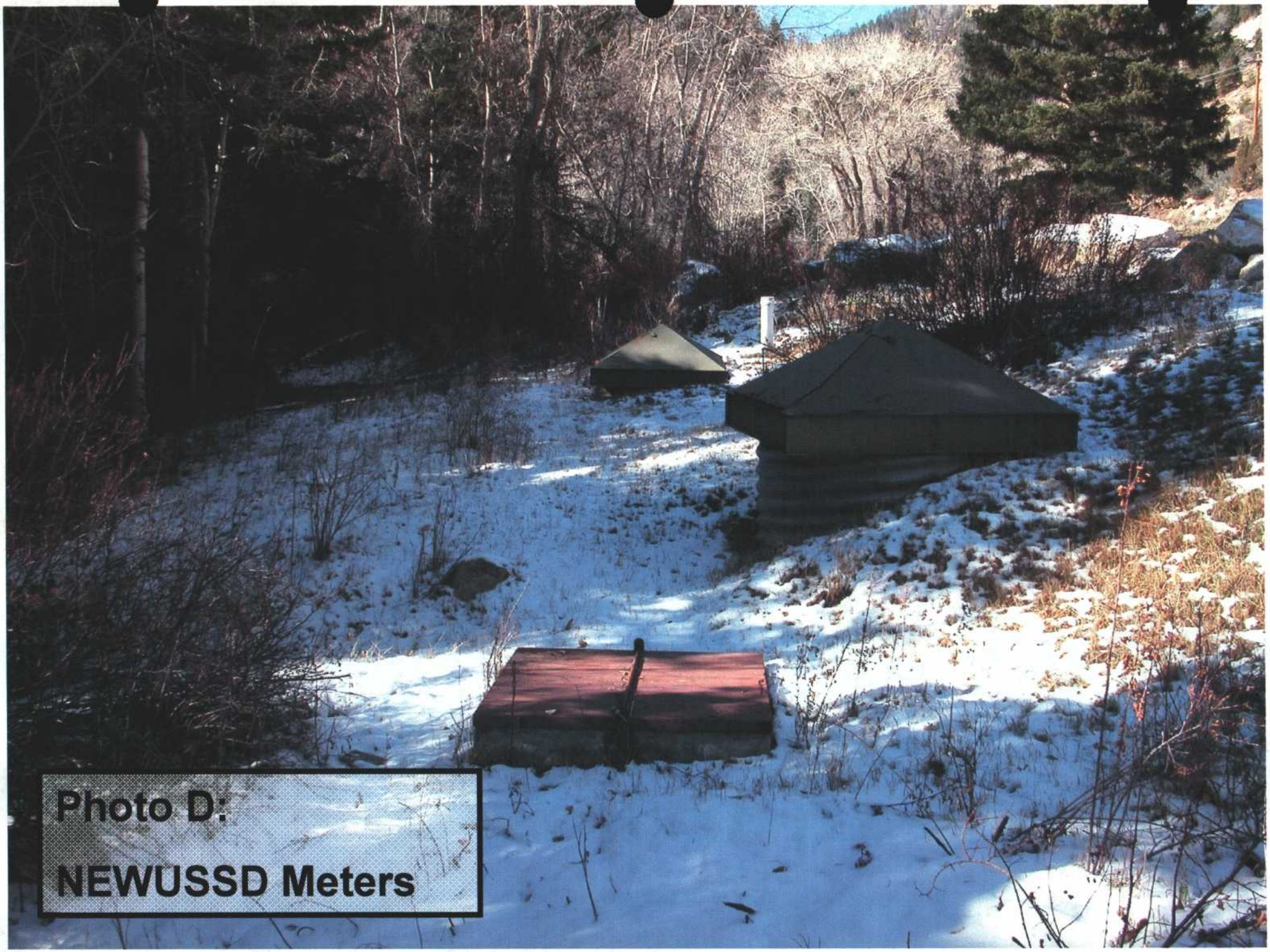


Photo D:
NEWUSSD Meters

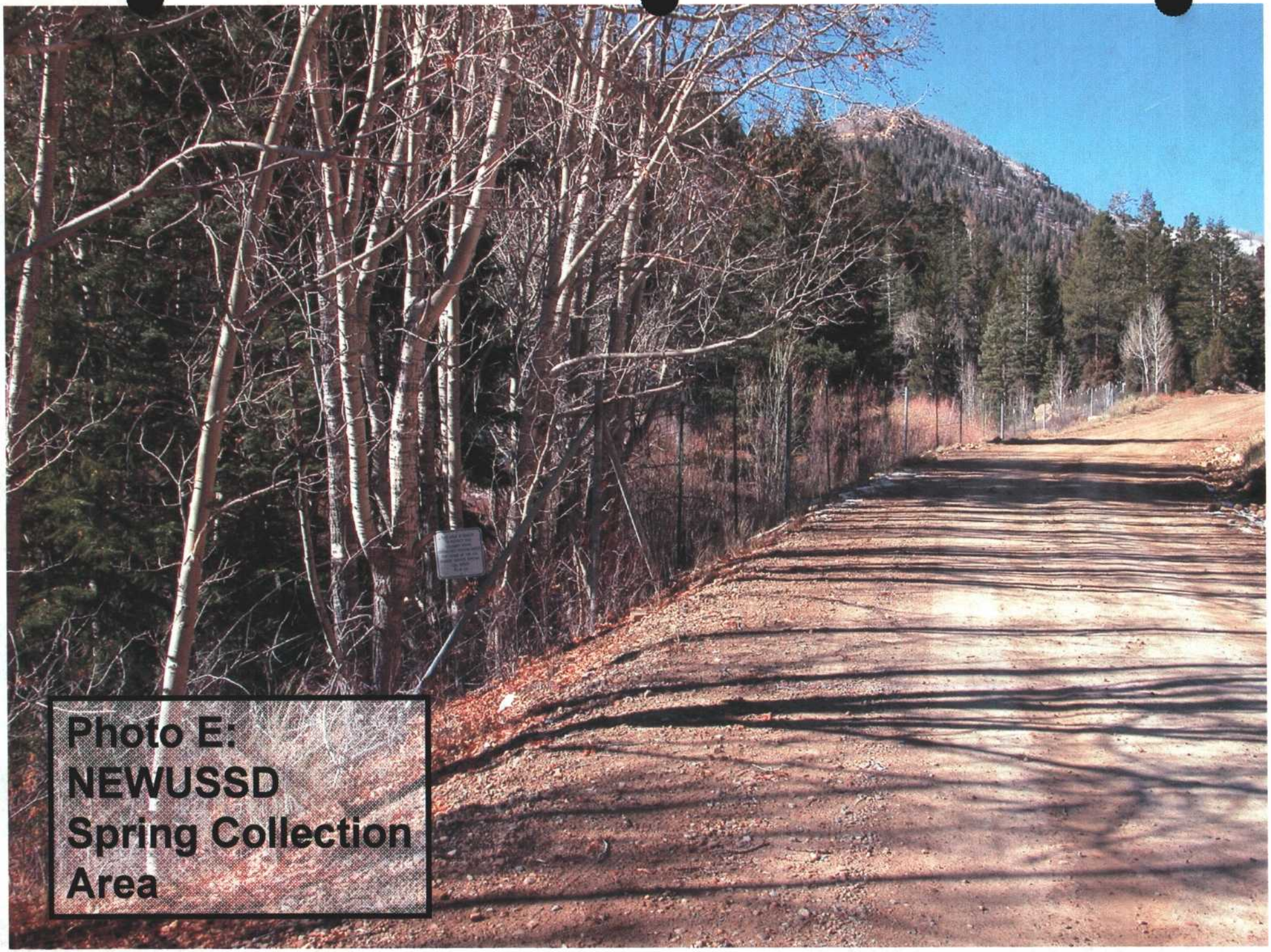


Photo E:
NEWUSSD
Spring Collection
Area

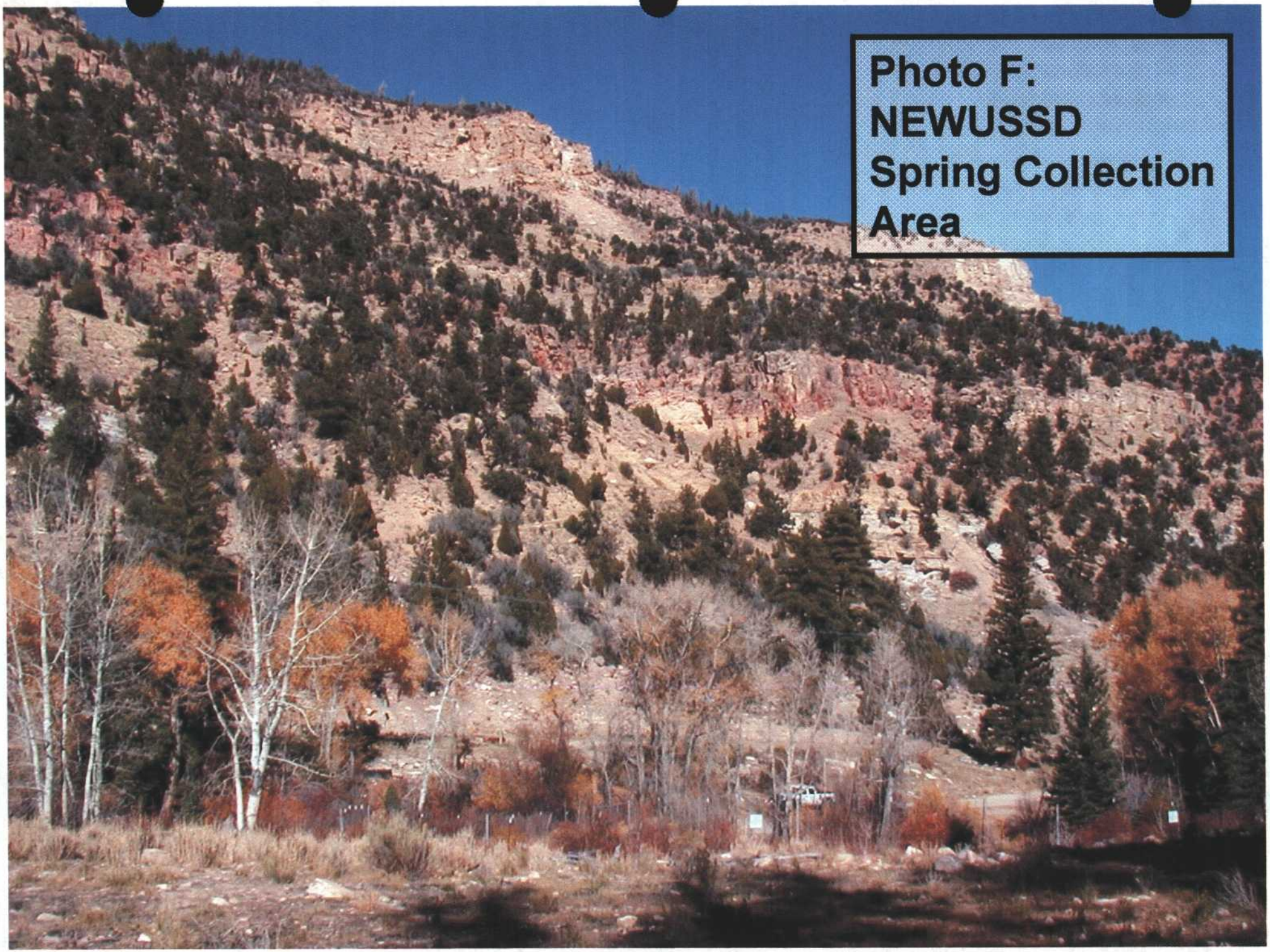


Photo F:
NEWUSSD
Spring Collection
Area

R645-301-500 ENGINEERING SECTION

APPENDIX G

♦RILDA CANYON PORTAL FACILITIES SITE PHOTOS

♦EXISTING ROADS

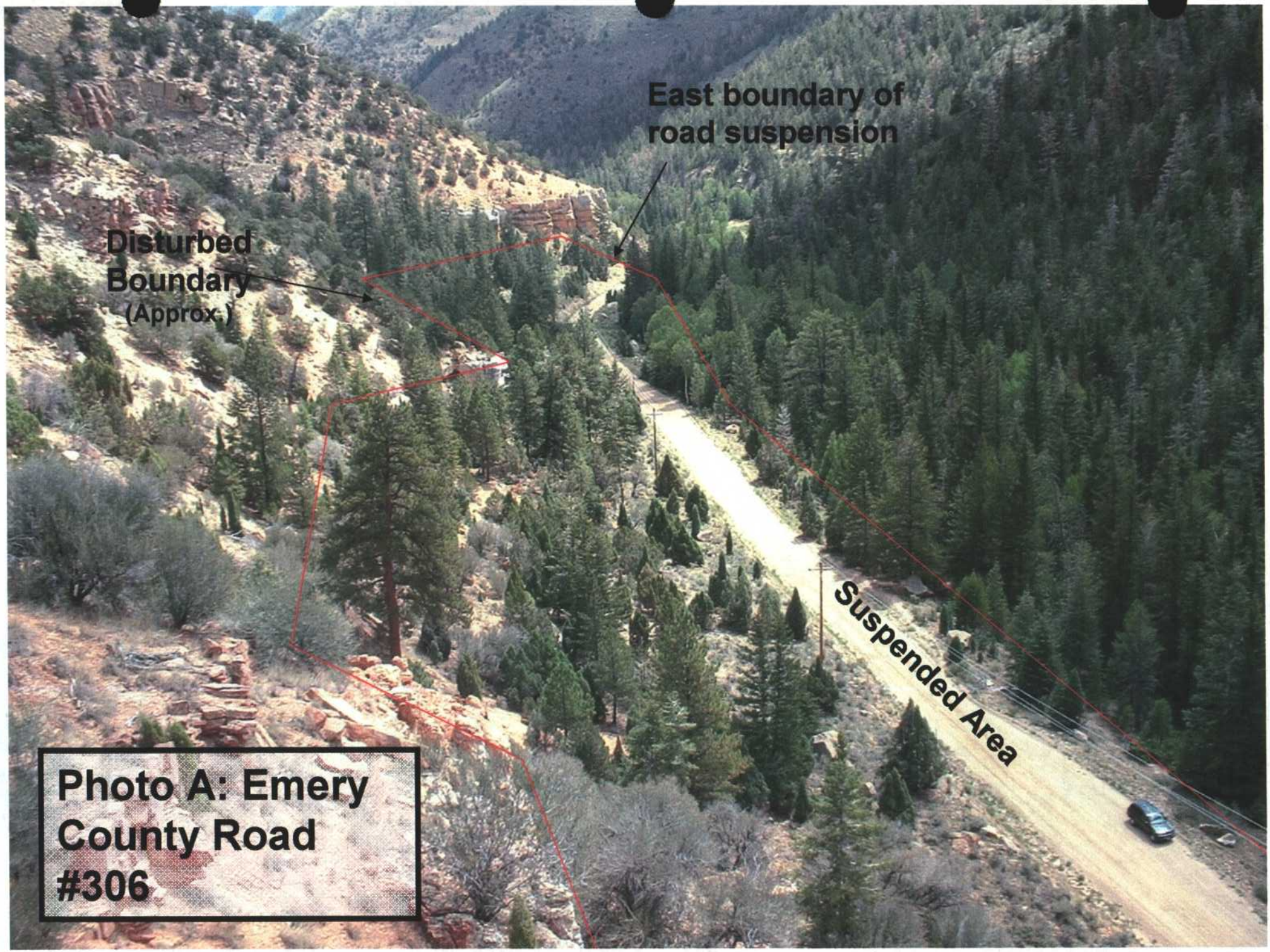


Photo A: Emery County Road #306

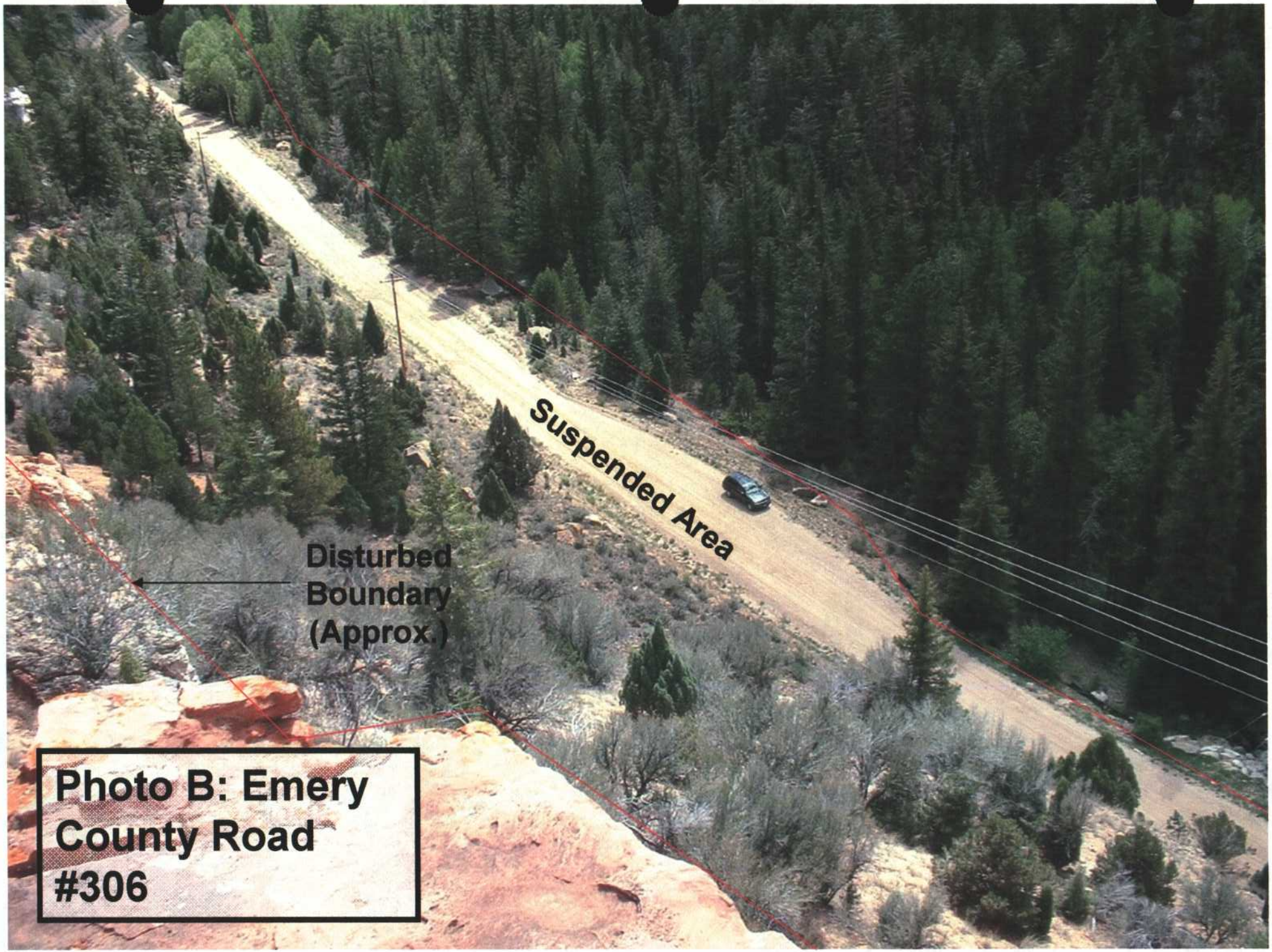


Photo B: Emery County Road #306

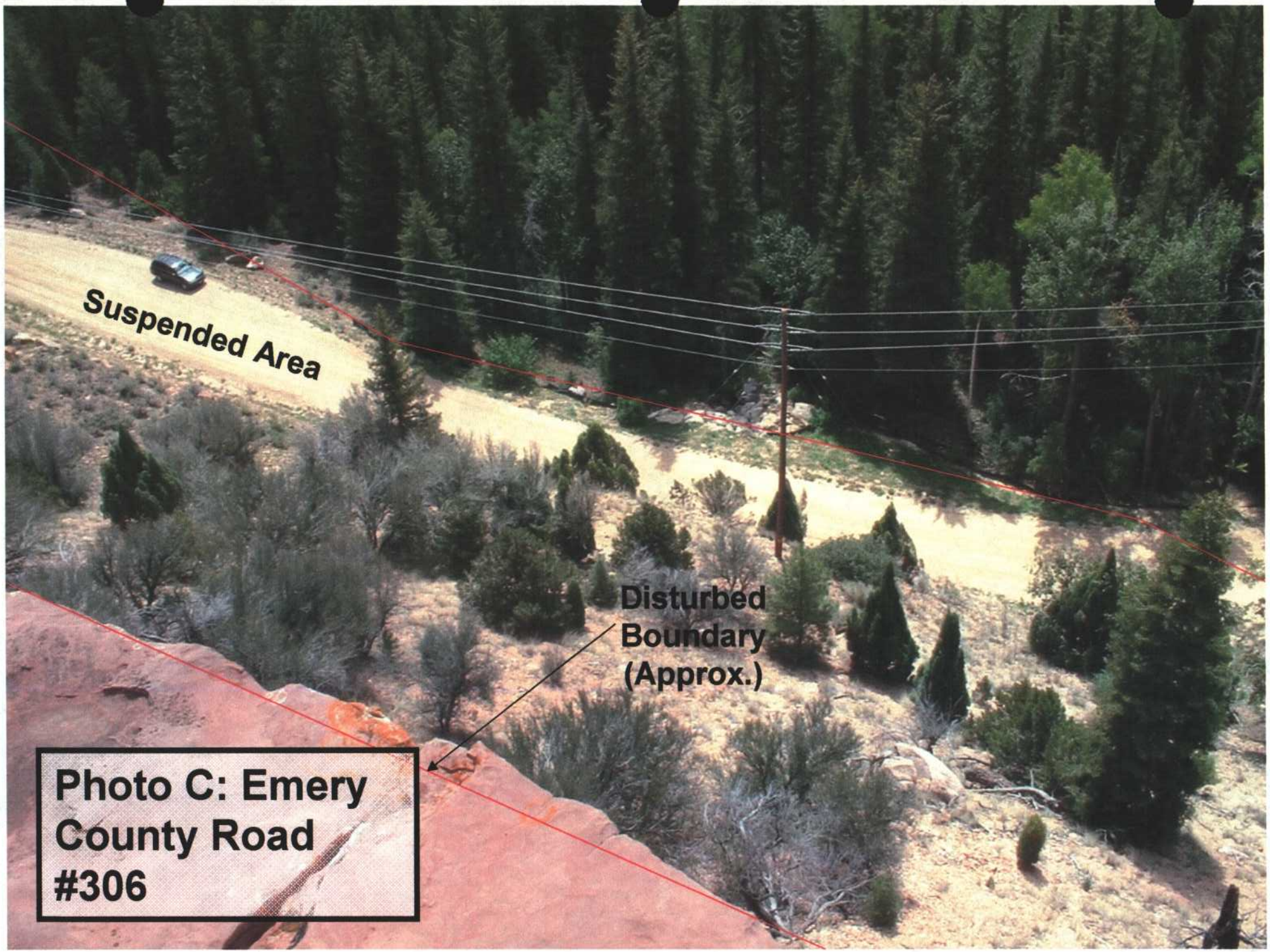


Photo C: Emery County Road #306

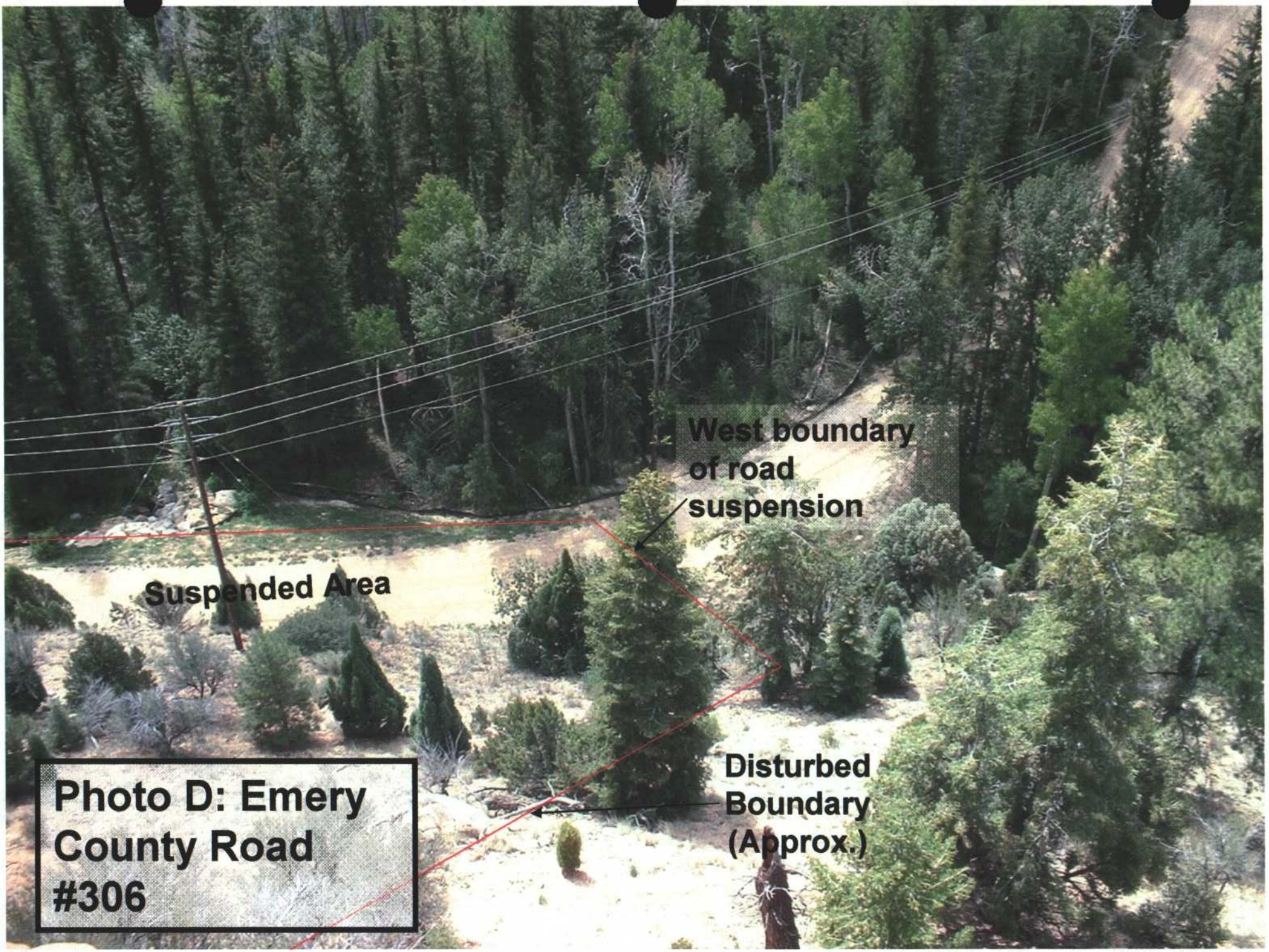


Photo D: Emery County Road #306

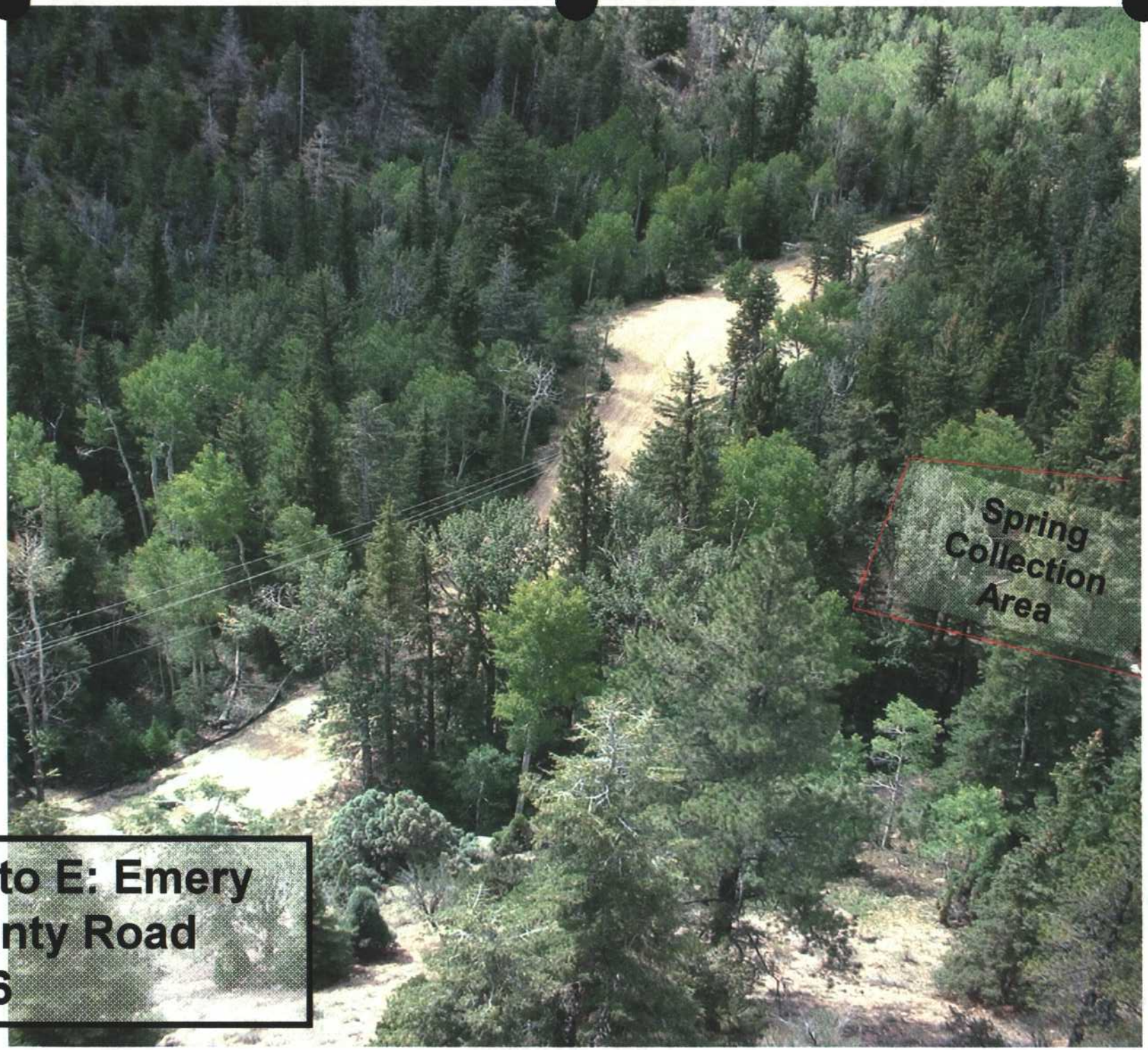


Photo E: Emery County Road #306