MINE PLAN of OPERATIONS

&

RECLAMATION PLAN FOR UNDERGROUND MINING

PRINCE ALBERT MINE

MONTROSE COUNTY, COLORADO

Submitted August 11, 2011

Revised
October 9, 2012

Submitted by:

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Exhibit A

Attachment A.8.4

Water Quality Sampling

San Miguel / Dolores River Confluence

2009 - 2010

WQCD Station 000084
Longitude : -108.803
Latitude: 38.38014

Water Quality Sample Results
San Miguel / Dolores River Confluence
2009 - 2010

Limited Impact 110 (d) Permit Application
Prince Albert Mine
Attachment U.8.4

Facility Code	Location Name	Sample Date	Sample Type Code	Matrix Code	Task Description	Lab Name Code	Analytic Method	Fraction	Chemical Name	Report Result Text	Report Result Unit	Reporting Detection Limit	Detection Limit Units
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	4/20/2010	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	2320	Total	Alkalinity, Total (total hydroxide+carbonate+bicarbonate)	76	mg/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	11/17/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	2320	Total	Alkalinity, Total (total hydroxide+carbonate+bicarbonate)	140	mg/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	9/15/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	2320	Total	Alkalinity, Total (total hydroxide+carbonate+bicarbonate)	160	mg/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	7/14/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	2320	Total	Alkalinity, Total (total hydroxide+carbonate+bicarbonate)	98	mg/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	5/12/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	2320	Total	Alkalinity, Total (total hydroxide+carbonate+bicarbonate)	68	mg/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	4/20/2010	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	200.8(W)	Dissolved	Cadmium	< 0.6	ug/l	0.6	ug/l
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	11/17/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	200.8(W)	Dissolved	Cadmium	< 0.6	ug/l	0.6	ug/l
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	9/15/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	200.8(W)	Dissolved	Cadmium	< 0.6	ug/l	0.6	ug/l
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	7/14/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	200.8(W)	Dissolved	Cadmium	< 0.6	ug/l	0.6	ug/l
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	5/12/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	200.8(W)	Dissolved	Cadmium	< 1	ug/l	1	ug/l
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	4/20/2010	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	200.7(W)	Dissolved	Copper	25	ug/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	11/17/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	200.7(W)	Dissolved	Copper	6	ug/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	9/15/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	200.7(W)	Dissolved	Copper	< 5	ug/l	5	ug/l
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	7/14/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	200.7(W)	Dissolved	Copper	< 5	ug/l	5	ug/l
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	5/12/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	200.7(W)	Dissolved	Copper	< 5	ug/l	5	ug/l
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	4/20/2010	F-MSR/OBS	SW	CDPHE Water and Biological Sampling		1002-8-2009	NA	Dissolved oxygen (DO)	9.7	mg/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	11/17/2009	F-MSR/OBS	SW	CDPHE Water and Biological Sampling		1002-8-2009	NA	Dissolved oxygen (DO)	12.79	mg/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	9/15/2009	F-MSR/OBS	SW	CDPHE Water and Biological Sampling		1002-8-2009	NA	Dissolved oxygen (DO)	9.32	mg/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	7/14/2009	F-MSR/OBS	SW	CDPHE Water and Biological Sampling		1002-8-2009	NA	Dissolved oxygen (DO)	9.51	mg/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	5/12/2009	F-MSR/OBS	SW	CDPHE Water and Biological Sampling		1002-8-2009	NA	Dissolved oxygen (DO)	9.03	mg/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	11/17/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	9223-B	Total	Escherichia coli	6.3	#/100ml		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	9/15/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	9223-B	Total	Escherichia coli	48	#/100ml		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	7/14/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	9223-B	Total	Escherichia coli	21.6	#/100ml		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	5/12/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	GJ	9223-B	Total	Escherichia coli	1119.85	#/100ml		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	4/20/2010	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	2340-B	Total	Hardness, Ca, Mg	110	mg/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	11/17/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	2340-B	Total	Hardness, Ca, Mg	390	mg/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	9/15/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	2340-B	Total	Hardness, Ca, Mg	730	mg/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	7/14/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	2340-B	Total	Hardness, Ca, Mg	260	mg/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	5/12/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	2340-B	Total	Hardness, Ca, Mg	110	mg/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	4/20/2010	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	200.7(W)	Dissolved	Iron	100	ug/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	4/20/2010	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	200.7(W)	Total Recv	Iron	3300	ug/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	11/17/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	200.7(W)	Dissolved	Iron	20	ug/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	11/17/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	200.7(W)	Total Recv	Iron	60	ug/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	9/15/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	200.7(W)	Dissolved	Iron	< 10	ug/l	10	ug/l
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	9/15/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	200.7(W)	Total Recv	Iron	130	ug/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	7/14/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	200.7(W)	Dissolved	Iron	23	ug/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	7/14/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	200.7(W)	Total Recv	Iron	230	ug/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	5/12/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	200.7(W)	Dissolved	Iron	99	ug/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	5/12/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	200.7(W)	Total Recv	Iron	8500	ug/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	4/20/2010	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	351.2	Total	Kjeldahl nitrogen	1.3	mg/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	11/17/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	351.2	Total	Kjeldahl nitrogen	0.67	mg/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	9/15/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	351.2	Total	Kjeldahl nitrogen	1.3	mg/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	7/14/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	351.2	Total	Kjeldahl nitrogen	< 0.5	mg/l	0.5	mg/l
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	5/12/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	351.2	Total	Kjeldahl nitrogen	< 0.5	mg/l	0.5	mg/l
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	4/20/2010	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	200.8(W)	Dissolved	Lead	< 1	ug/l	1	ug/l
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	11/17/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	200.8(W)	Dissolved	Lead	< 1	ug/l	1	ug/l
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	9/15/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	200.8(W)	Dissolved	Lead	< 1	ug/l	1	ug/l
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	7/14/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	200.8(W)	Dissolved	Lead	< 1	ug/l	1	ug/l
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	5/12/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	200.8(W)	Dissolved	Lead	< 1	ug/l	1	ug/l
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	4/20/2010	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	200.7(W)	Dissolved	Manganese	10	ug/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	11/17/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	200.7(W)	Dissolved	Manganese	24	ug/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	9/15/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	200.7(W)	Dissolved	Manganese	19	ug/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	7/14/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	200.7(W)	Dissolved	Manganese	10	ug/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	5/12/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	200.7(W)	Dissolved	Manganese	16	ug/l		

WQCD Station 000084
Longitude : -108.803
Latitude: 38.38014

Water Quality Sample Results
San Miguel / Dolores River Confluence
2009 - 2010

Limited Impact 110 (d) Permit Application
Prince Albert Mine
Attachment U.8.4

Facility Code	Location Name	Sample Date	Sample Type Code	Matrix Code	Task Description	Lab Name Code	Analytic Method	Fraction	Chemical Name	Report Result Text	Report Result Unit	Reporting Detection Limit	Detection Limit Units
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	4/20/2010	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	350.1	Total	Nitrogen, ammonia (NH3) + ammonium (NH4)	< 0.03	mg/l	0.03	mg/l
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	11/17/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	350.1	Total	Nitrogen, ammonia (NH3) + ammonium (NH4)	0.33	mg/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	9/15/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	350.1	Total	Nitrogen, ammonia (NH3) + ammonium (NH4)	0.81	mg/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	7/14/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	350.1	Total	Nitrogen, ammonia (NH3) + ammonium (NH4)	0.04	mg/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	5/12/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	350.1	Total	Nitrogen, ammonia (NH3) + ammonium (NH4)	0.066	mg/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	4/20/2010	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	353.2	Total	Nitrogen, Nitrite (NO2) + Nitrate (NO3) as N	0.12	mg/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	11/17/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	353.2	Total	Nitrogen, Nitrite (NO2) + Nitrate (NO3) as N	< 0.05	mg/l	0.05	mg/l
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	9/15/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	353.2	Total	Nitrogen, Nitrite (NO2) + Nitrate (NO3) as N	0.23	mg/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	7/14/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	353.2	Total	Nitrogen, Nitrite (NO2) + Nitrate (NO3) as N	< 0.05	mg/l	0.05	mg/l
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	5/12/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	353.2	Total	Nitrogen, Nitrite (NO2) + Nitrate (NO3) as N	0.13	mg/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	4/20/2010	F-MSR/OBS	SW	CDPHE Water and Biological Sampling		150.1	Total	pH	8.02	None		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	11/17/2009	F-MSR/OBS	SW	CDPHE Water and Biological Sampling		150.1	Total	pH	8.37	None		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	9/15/2009	F-MSR/OBS	SW	CDPHE Water and Biological Sampling		150.1	Total	pH	8.42	None		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	7/14/2009	F-MSR/OBS	SW	CDPHE Water and Biological Sampling		150.1	Total	pH	8.96	None		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	5/12/2009	F-MSR/OBS	SW	CDPHE Water and Biological Sampling		150.1	Total	pH	8.08	None		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	4/20/2010	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	365.1	Total	Phosphorus as P	0.11	mg/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	11/17/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	365.1	Total	Phosphorus as P	< 0.01	mg/l	0.01	mg/l
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	9/15/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	365.1	Total	Phosphorus as P	0.01	mg/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	7/14/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	365.1	Total	Phosphorus as P	0.01	mg/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	5/12/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	365.1	Total	Phosphorus as P	0.23	mg/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	4/20/2010	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	200.8(W)	Dissolved	Selenium	< 1	ug/l	1	ug/l
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	11/17/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	200.8(W)	Dissolved	Selenium	< 1	ug/l	1	ug/l
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	9/15/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	200.8(W)	Dissolved	Selenium	< 1	ug/l	1	ug/l
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	7/14/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	200.8(W)	Dissolved	Selenium	< 1	ug/l	1	ug/l
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	5/12/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	200.8(W)	Dissolved	Selenium	< 1	ug/l	1	ug/l
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	4/20/2010	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	200.8(W)	Dissolved	Silver	< 0.3	ug/l	0.3	ug/l
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	11/17/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	200.8(W)	Dissolved	Silver	< 0.3	ug/l	0.3	ug/l
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	9/15/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	200.8(W)	Dissolved	Silver	< 0.3	ug/l	0.3	ug/l
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	7/14/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	200.8(W)	Dissolved	Silver	< 0.3	ug/l	0.3	ug/l
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	5/12/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	200.8(W)	Dissolved	Silver	< 1	ug/l	1	ug/l
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	4/20/2010	F-MSR/OBS	SW	CDPHE Water and Biological Sampling		120.1	Total	Specific conductance	249.6	uS/cm		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	11/17/2009	F-MSR/OBS	SW	CDPHE Water and Biological Sampling		120.1	Total	Specific conductance	953.9	uS/cm		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	9/15/2009	F-MSR/OBS	SW	CDPHE Water and Biological Sampling		120.1	Total	Specific conductance	1809	uS/cm		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	7/14/2009	F-MSR/OBS	SW	CDPHE Water and Biological Sampling		120.1	Total	Specific conductance	606.1	uS/cm		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	5/12/2009	F-MSR/OBS	SW	CDPHE Water and Biological Sampling		120.1	Total	Specific conductance	275.2	uS/cm		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	4/20/2010	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	300(A)	Total	Sulfur, sulfate (SO4) as SO4	39	mg/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	11/17/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	300(A)	Total	Sulfur, sulfate (SO4) as SO4	320	mg/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	9/15/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	300(A)	Total	Sulfur, sulfate (SO4) as SO4	780	mg/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	7/14/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	300(A)	Total	Sulfur, sulfate (SO4) as SO4	180	mg/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	5/12/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	300(A)	Total	Sulfur, sulfate (SO4) as SO4	48	mg/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	4/20/2010	F-MSR/OBS	SW	CDPHE Water and Biological Sampling	LSD	170.1	NA	Temperature, water	10.1	deg C		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	11/17/2009	F-MSR/OBS	SW	CDPHE Water and Biological Sampling	LSD	170.1	NA	Temperature, water	0.87	deg C		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	9/15/2009	F-MSR/OBS	SW	CDPHE Water and Biological Sampling	LSD	170.1	NA	Temperature, water	18.85	deg C		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	7/14/2009	F-MSR/OBS	SW	CDPHE Water and Biological Sampling	LSD	170.1	NA	Temperature, water	20.54	deg C		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	5/12/2009	F-MSR/OBS	SW	CDPHE Water and Biological Sampling		170.1	NA	Temperature, water	11.83	deg C		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	4/20/2010	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	200.8(W)	Dissolved	Uranium-238	< 1	ug/l	1	ug/l
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	4/20/2010	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	200.7(W)	Dissolved	Zinc	< 10	ug/l	10	ug/l
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	11/17/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	200.7(W)	Dissolved	Zinc	< 10	ug/l	10	ug/l
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	9/15/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	200.7(W)	Dissolved	Zinc	< 10	ug/l	10	ug/l
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	7/14/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	200.7(W)	Dissolved	Zinc	31	ug/l		
WQC_ENV	SAN MIGUEL R AT CONFL WITH DOLORES	5/12/2009	S-ROUTINE	SW	CDPHE Water and Biological Sampling	LSD	200.7(W)	Dissolved	Zinc	18	ug/l		

Exhibit A

Attachment A.8.3

Prince Albert Mine

Surface Water Controls

Construction Schedule

Exhibit A **Attachment A.8.3**

Prince Albert Mine

Surface Water Controls Construction Schedule

The construction schedule for the Prince Albert Mine surface water control structures is designed to ensure that an adequate system of surface water control is in place at all times during the life of the mine. This schedule establishes a series of construction milestones that must be met as work progresses under the mining plan. The construction schedule is event driven and not tied to particular calendar dates.

Note: Please refer to the Exhibit A, Attachment A.8.2, Exhibit A -1 through A -5 Surface Water Control and Containment Facilities drawings for construction details.

Milestone 1: All work under this milestone is to be completed prior to the deposition on the surface of any new waste rock materials mined from the underground workings under the Limited Impact 110(d) permit.

• Construct East and West Diversion Swales — The diversion swales labeled DS on the construction drawings will be constructed.

• Install North and West Silt Fencing — The silt fencing (labeled SF on the construction drawings) that must be installed from the location labeled Existing Container to the location labeled North Pond will be installed.

• Complete Central Pond — The detention pond identified as the Central Pond on the construction drawings will be completed. The initial containment structure was completed as part of the Bulk Sample NOI. The pond bank will be extended south to the primary magazine location and the pond construction will be completed in accordance with the construction drawings.

• Construct Temporary Diversion Ditch /Berms — A series of temporary surface water diversion ditches and / or berms will be constructed to route direct precipitation surface runoff from the area north of the location labeled Portal and Service Area to the North Pond location. These temporary diversions will be constructed along the toe of the existing surface - deposited waste rock materials to collect and route runoff to the North Pond using existing natural drainage paths. These temporary diversions will be relocated to always remain in front of the waste dump toe as additional excavated material is added to the waste dumps.

Milestone 3: All work under this milestone will be performed as part of an ongoing process during the initial phase of underground exploration work. This work is to be completed as soon as enough suitable material is excavated and brought to the surface from the underground workings under the 110(d) permit.

• Construct North Pond: The initial containment will be formed by pushing the existing soils from the area labeled North Pond on the construction drawings up into a berm to form the north bank of the containment. Waste rock excavated underground from outside the uranium - mineralized zone will then be brought to the surface as it is being mined and used to construct the pond banks inside of the earthen berm in accordance with the specifications detailed in the construction drawings. The earthen berm will be used as growth medium and graded over the top of the reclaimed pond banks during the final site reclamation.

Milestone 4: All work under this milestone is to be completed prior to the deposition on the surface of any new ore materials mined from the underground workings under the 110(d) permit.

• Finalize Construction of the Ore Pad Pond — The construction of the containment structure identified as the Ore Pad Pond in the construction drawings was largely completed under the Bulk Sample NOI. The existing structure will be checked for completeness and finished to the final configuration specified on the construction drawings, if necessary.

Milestone 5: Silt fencing will be installed around the planned down - gradient footprint of the Topsoil Stockpile prior to the first placement of growth material at the Topsoil Stockpile location.

Milestone 6: All work under this milestone is to be completed prior to the deposition on the surface at the Secondary Waste Dump location of any new waste rock materials mined from the underground workings under the 110(d) permit.

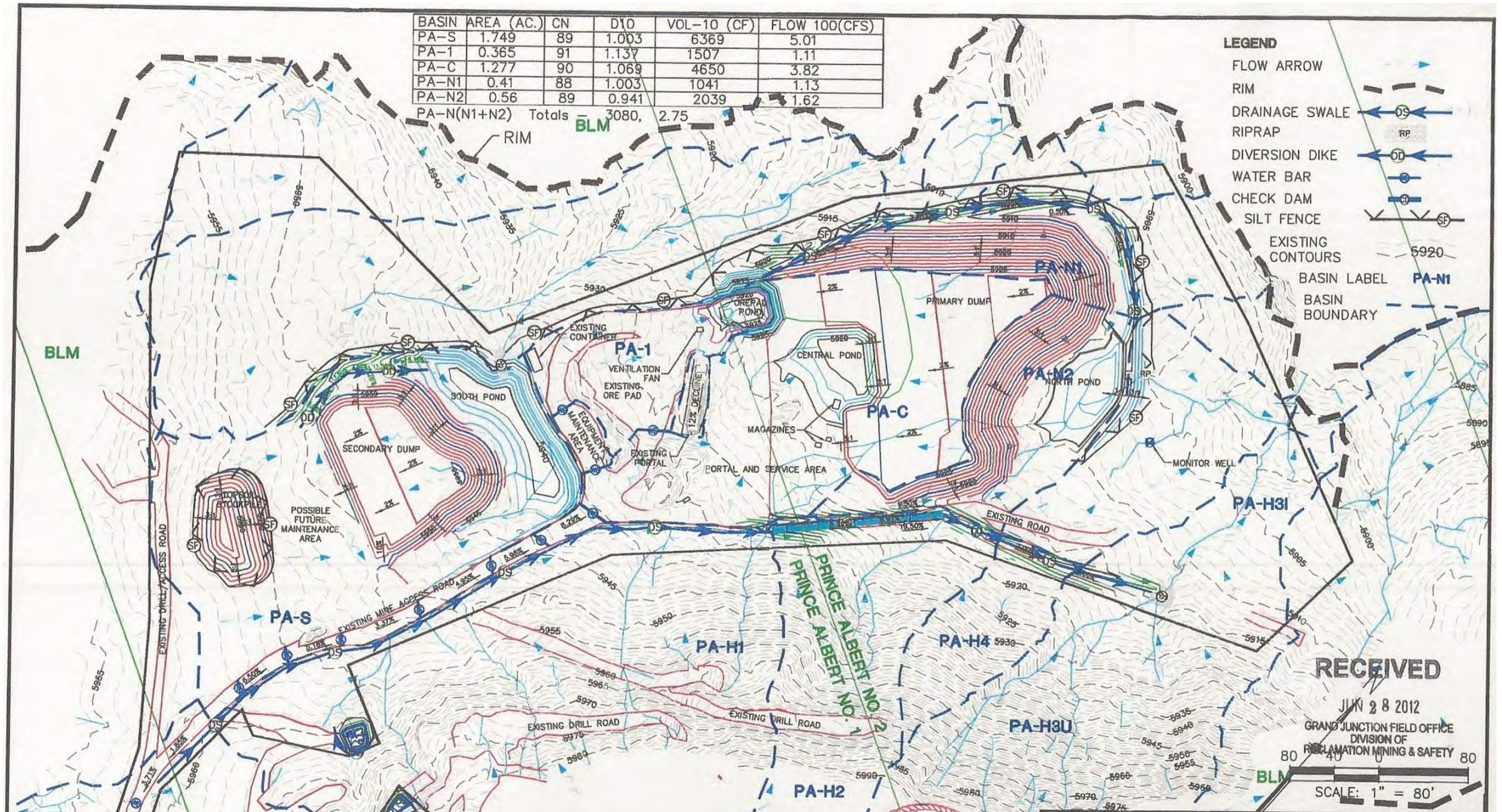
• Install Silt Fencing — The silt fence (labeled SF on the construction drawings) running south from the location labeled Existing Container to its terminus point west of the Secondary Waste Dump will be installed.

• Construct South Pond — The pond labeled as South Pond on the construction drawings will be constructed using waste rock excavated from outside the uranium - mineralized zone. The bank material will be pushed over the top of the cleaned ore pad location and used as part of the final ore pad cover material at the time of final site reclamation.

Attachment A.8.2

Exhibits A1 through A5

BASIN	AREA (AC.)	CN	D10	VOL-10 (CF)	FLOW 100(CFS)
PA-S	1.749	89	1.003	6369	5.01
PA-1	0.365	91	1.137	1507	1.11
PA-C	1.277	90	1.069	4650	3.82
PA-N1	0.41	88	1.003	1041	1.13
PA-N2	0.56	89	0.941	2039	1.62
PA-N(N1+N2)	Totals			3080,	2.75



BASIN	AREA (AC.)	CN	D10	FLOW 100(CFS)
PA-H1	2.91	89	1.003	8.35
PA-H2	1.03	89	1.003	2.96
PA-H3	0.31	89	1.003	0.88
PA-H4	1.77	89	1.003	5.08

RIMROCK EXPLORATION & DEVELOPMENT

PRINCE ALBERT MINE - 110D PERMIT APPLICATION

EXHIBIT A-1 - OVERALL PLAN

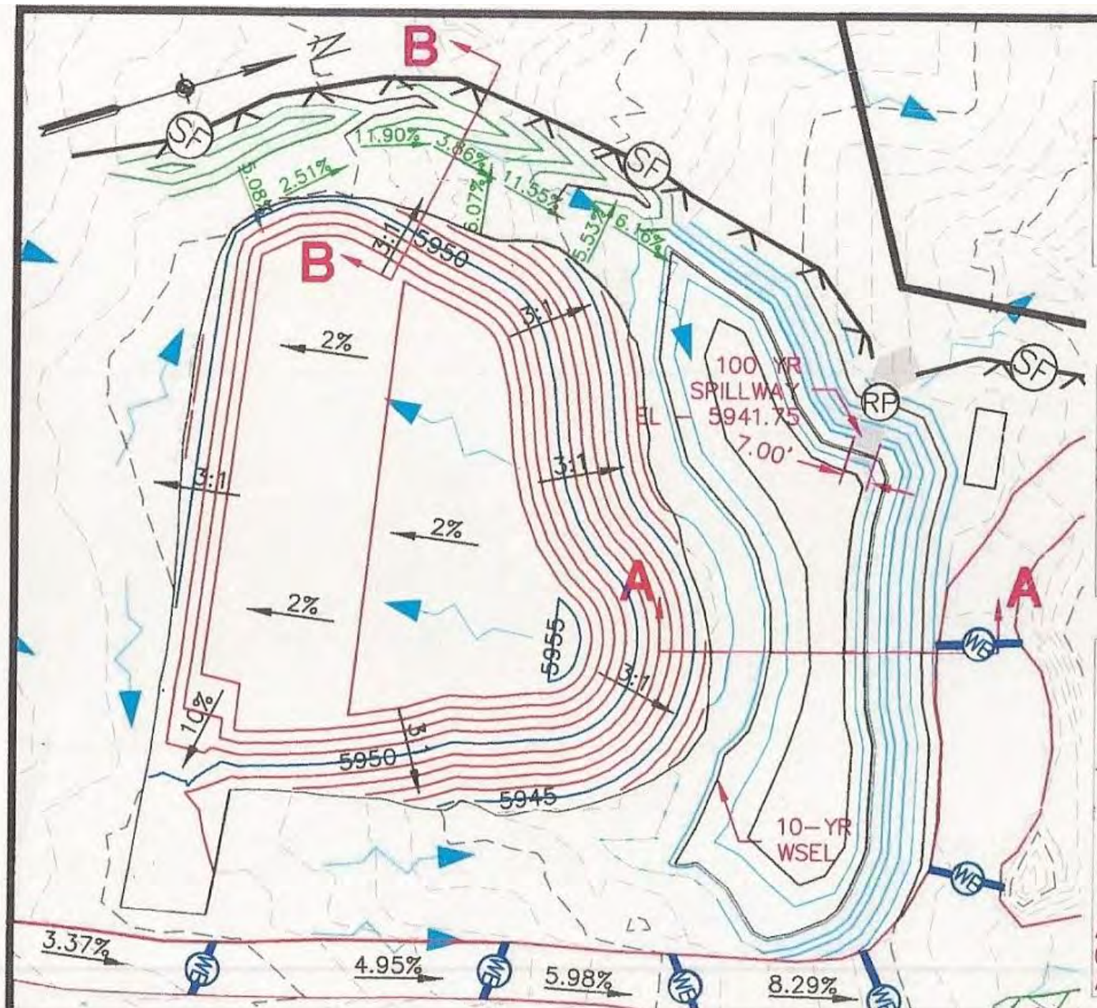
Surface Water Control and Containment Facilities

DATE: 6/14/12

DRAWN BY: JCP, JR.

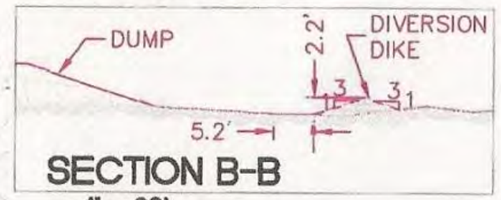
SHEET 1 OF 5

JAMES C. PIERCE, JR.
P.O. BOX 100
NUCLA, COLORADO 81424
(970) 864-7455



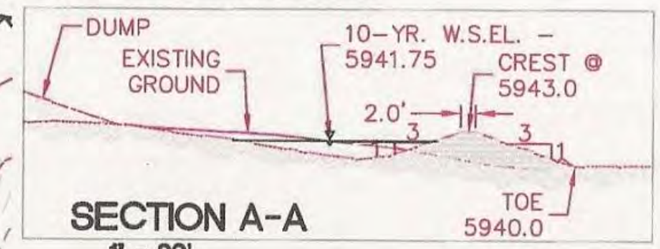
PLAN VIEW
1" = 40'

DIVERSION DIKE

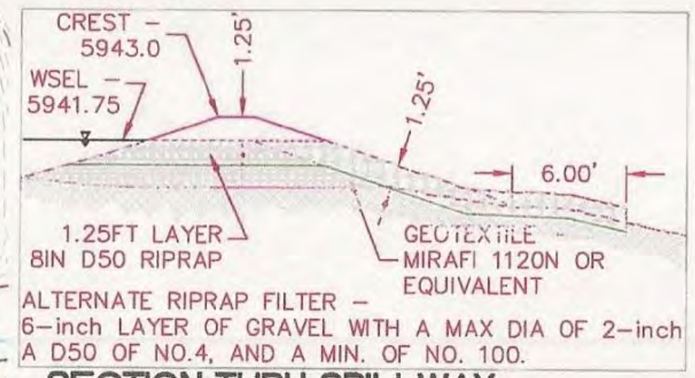


SECTION B-B
1" = 20'

SOUTH DETENTION



SECTION A-A
1" = 20'



SECTION THRU SPILLWAY
1/8" = 1'

100-YR/24HR PEAK DESIGN FLOW - 5.01 CFS

Channel Data	Maximum		Minimum
Slope	0.1155 ft/ft	-	0.025 ft/ft
Manning's n	0.0280		
Height	24.0 in		
Width	62.0 in		0.0 in
Left slope	0.333 ft/ft (V/H)	-	0.052 ft/ft
Right slope	0.050 ft/ft (V/H)	-	0.333 ft/ft

Computed Results:

Depth	1.91 in	-	4.8 in
Velocity	4.54 fps	-	2.8 fps
Percent full	7.9 %	-	19.9 %

DETENTION POND 10-YR/24 HR DESIGN VOLUME -

BASIN	AREA	CN	D10	VOLUME
PA-S	1.749	89	1.003	6,369

VOLUME PROVIDED @ ELEVATION (MODIFIED SPILLWAY) -

ELEV	AREA	CONIC
5943.0	8304.86	15,009.2
5942.0	5973.22	7,902.1
5941.75	5520.33	6,517.7
5941.0	3897.19	3,003.7
5940.0	2191.55	0.0

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DETENTION POND 100-YR/24 HR DESIGN VOLUME -

BASIN	AREA	CN	D100	VOLUME
PA-S	1.749	89	1.873	11,890

SPILLWAY RIPRAP DESIGN
100-YR/24HR PEAK DESIGN FLOW - 5.01 CFS

Height of flow (Broad Crested Weir) - H=(Q/CL)^2/3

For C = 2.84, Q = 5.01 cfs, L = 84 in

H = 4.79 in, Spillway Elevation @ 5941.75, Crest @ 5943.0

RIPRAP DESIGN - FROM PAP-0790 - SIMPLIFIED DESIGN GUIDELINES
FOR RIPRAP SUBJECTED TO OVERTOPPING FLOW (BuRec, CSU)

D50 Cu^1/4=0.55(qf^0.52/S^3/4)(sin a/(Gs cos a-1)(cos a tan phi-sin a))^1.11
D50=(0.55(qf^0.52/S^3/4)(sin a/(Gc cos a-1)(cos a tan phi-sin a))^1.11)/Cu^1/4

FOR SOUTH POND -
D50 = median stone size (m)
Cu = coefficient of uniformity = 1.95, qf = unit discharge (m3/m/s) = 0.066
S = embankment slope (unitless) = 0.333, a = embankment slope (degrees) = 18.43
Gs = specific gravity of riprap = 2.24, phi = angle of repose of the riprap = 42

For interstitial flow, Vi (flow velocity) = (gD50)^0.5*2.48s^0.58*CU^-2.22
where s = slope in ft per ft = 0.333
Vi = (32.16x(5/12))^0.5x(2.48x(0.333)^0.58)x(1.95^-2.22) = 1.090 fps
Average velocity is the interstitial velocity multiplied by the porosity (Np) of the riprap - Vav = Vi x Np.

for Np = 0.45, Vav = 1.090x0.45 = 0.49 fps.
Depth of flow is the flow quantity divided by the average velocity - Y = Q/Vav, Y = (5.01/7ft.)/0.49fps = 1.46 ft. or 17.5 in., using an integer multiple of D50 for thickness gives 4xD50 for 20 inches of 5 in. D50 riprap.

To provide a safety factor use a riprap with a D50 of 7.5 in.

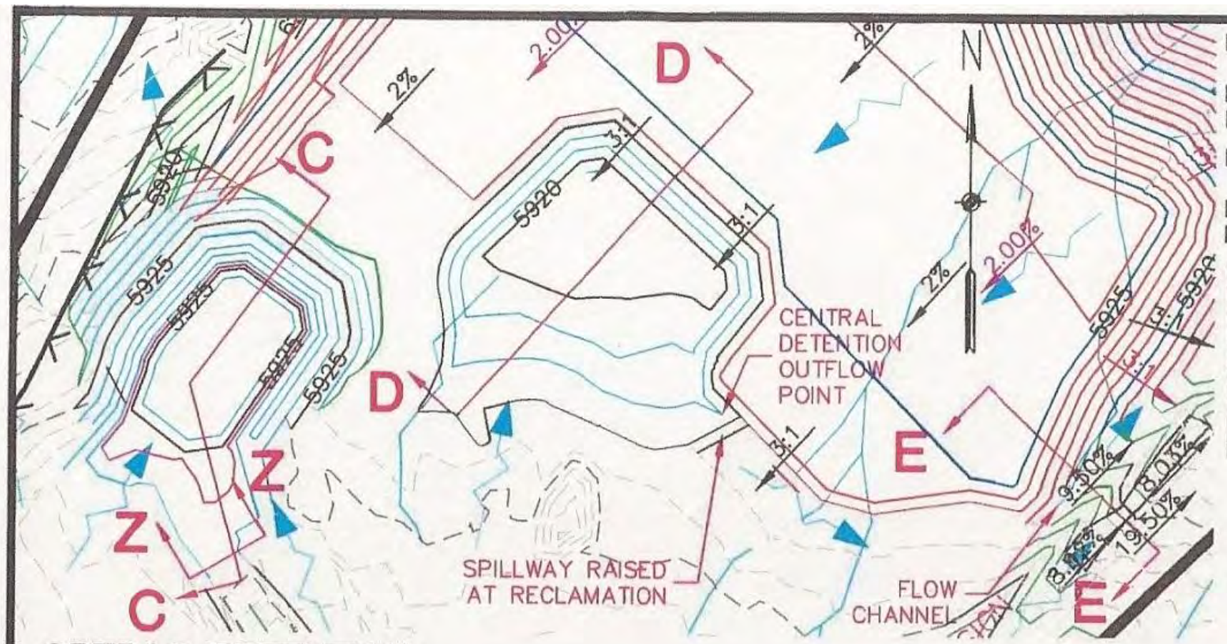
Vi = (32.16x(7.5/12))^0.5x(2.48x(0.333)^0.58)
x(1.95^-2.22) = 1.33 fps
Vav = 1.19x0.45 = 0.60 fps.
Y = (5.01cfs/7ft)/0.60fps = 1.19 ft or 14.3 in. using

COLORADO REGISTERED PROFESSIONAL ENGINEER
STEPHEN C. HOLLINS
25736
6/26/12

NOTE -

SEE SHEET U-5 FOR TYPICAL SETIONS (LATERAL) THRU SPILLWAY.

RIMROCK EXPLORATION & DEVELOPMENT	
PRINCE ALBERT MINE - 110D PERMIT APPLICATION	
EXHIBIT A-2 - STRUCTURES	
Surface Water Control and Containment Facilities	
DATE: 6/14/12	JAMES C. PIERCE, JR.



OREPAD DETENTION

DETENTION POND 10-YR/24 HR DESIGN VOLUME –

BASIN	AREA	CN	D10	VOLUME
PA-C	1.277	90	1.069	4,650

DETENTION POND 100-YR/24 HR DESIGN VOLUME

BASIN	AREA	CN	D10	VOLUME
PA-C	1.277	90	1.957	8,681

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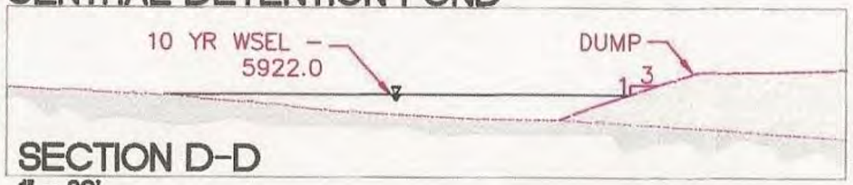
VOLUME PROVIDED @ ELEVATION 5922.0 – 5837 CU.FT.

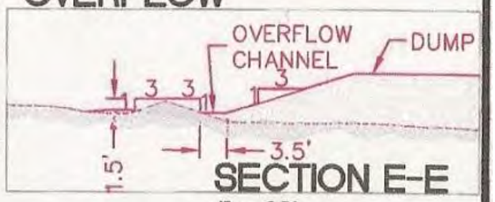
ELEV	AREA	VOL (CONIC)
5923.0	5060	9254.6
5922.0	3646	4921.2
5921.0	2459	1888.3
5920.0	1370	0.0

CENTRAL DETENTION POND



SECTION D-D
1" = 20'

CENTRAL DETENTION OVERFLOW



SECTION E-E
1" = 20'

DETENTION POND 24 HR/10/100 – YR DESIGN VOLUME

BASIN	AREA	CN	D10	VOLUME
PA-1	0.365	92	1.210	1,603

BASIN	AREA	CN	D100	VOLUME
PA-1	0.365	92	2.133	2,826

VOLUME PROVIDED –

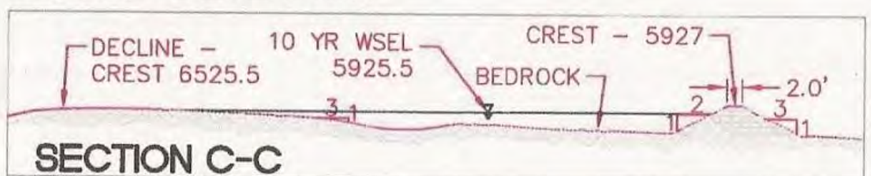
ELEV	AREA	VOL (CONIC)
5926.0	2273.78	2768.8
5925.5	1616.33	1800.9
5925.0	1234.64	1090.3
5924.0	952.06	0.0

100-YR PEAK DESIGN FLOW – 3.82 CFS

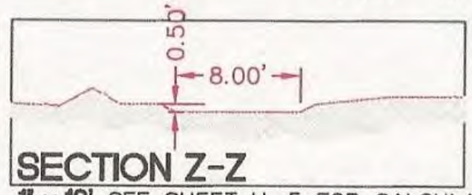
Channel Data

Flowrate	3.82 cfs
Slope	0.095 ft/ft
Height	18.0 in
Bottom Width	42.0 in
Left slope	0.33 ft/ft (V/H)
Right slope	0.33 ft/ft (V/H)
Manning's n	0.0280
Depth	2.10 in
Velocity	4.73 fps
Percent full	8.76 %

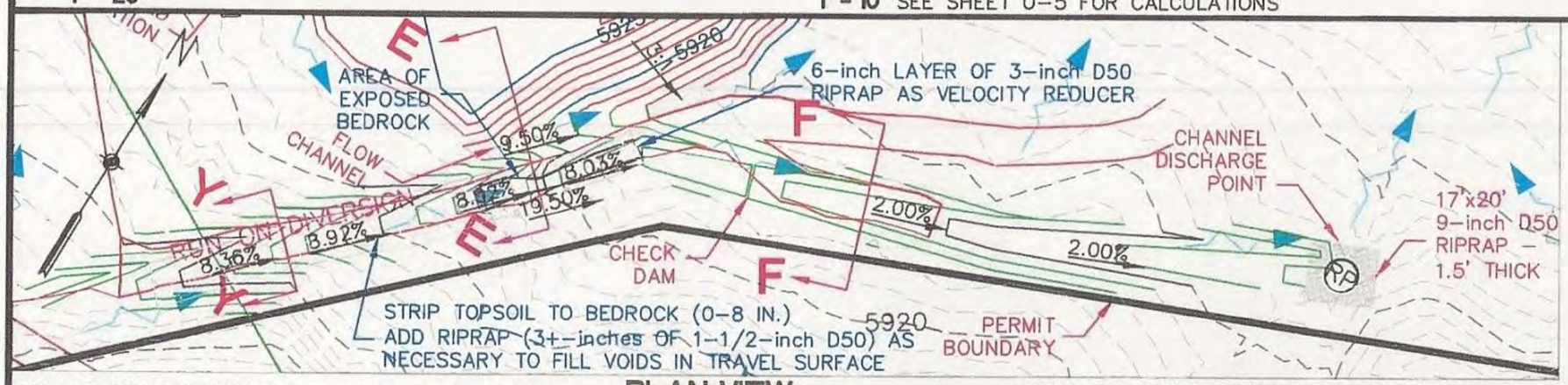
COLORADO REGISTERED PROFESSIONAL ENGINEER STEPHEN G. WILKINS 25736 6/26/12



SECTION C-C
1" = 20'



SECTION Z-Z
1" = 10' SEE SHEET U-5 FOR CALCULATIONS



PLAN VIEW
1" = 40'

100-YR PEAK DESIGN FLOW – RUN ON DIVERSION –

	SECTION Y-Y	SECTION E-E		SECTION F-F
Flow	8.35 cfs	8.35 cfs	–	11.31 cfs
Slope	0.089 ft/ft	0.195 ft/ft	–	0.020 ft/ft
Depth	18.0 in			
Bottom width	60.0 in	60.0 in		60.0 in
Left slope	0.33 ft/ft (V/H	0.33 ft/ft (V/H)	–	0.33 ft/ft (V/H)
Right slope	0.133 ft/ft (V/H)	0.133 ft/ft (V/H)	–	0.33 ft/ft (V/H)
Manning's n	0.0390	0.0350	–	0.028

DISCHARGE POINT RIPRAP PROTECTION SIZING –

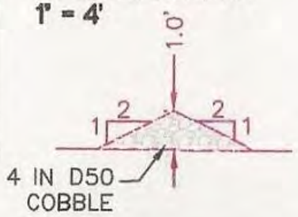
Slope	0.05 ft/ft
Manning's n	0.0352
Depth	5.33 in
Velocity	4.90 fps

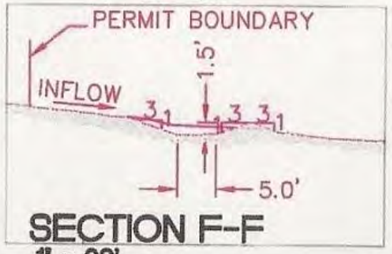
Using the Shear Stress design formula – ST=62.4xdxs, where d is depth (ft) and s is slope (ft/ft) yields a ST of 1.4 which equates to a 9-inch D50 RIPRAP

EAST RUN ON DIVERSION SWALE

SECTION E-E
1" = 20'

CHECK DAM
1" = 4'





SECTION F-F
1" = 20'

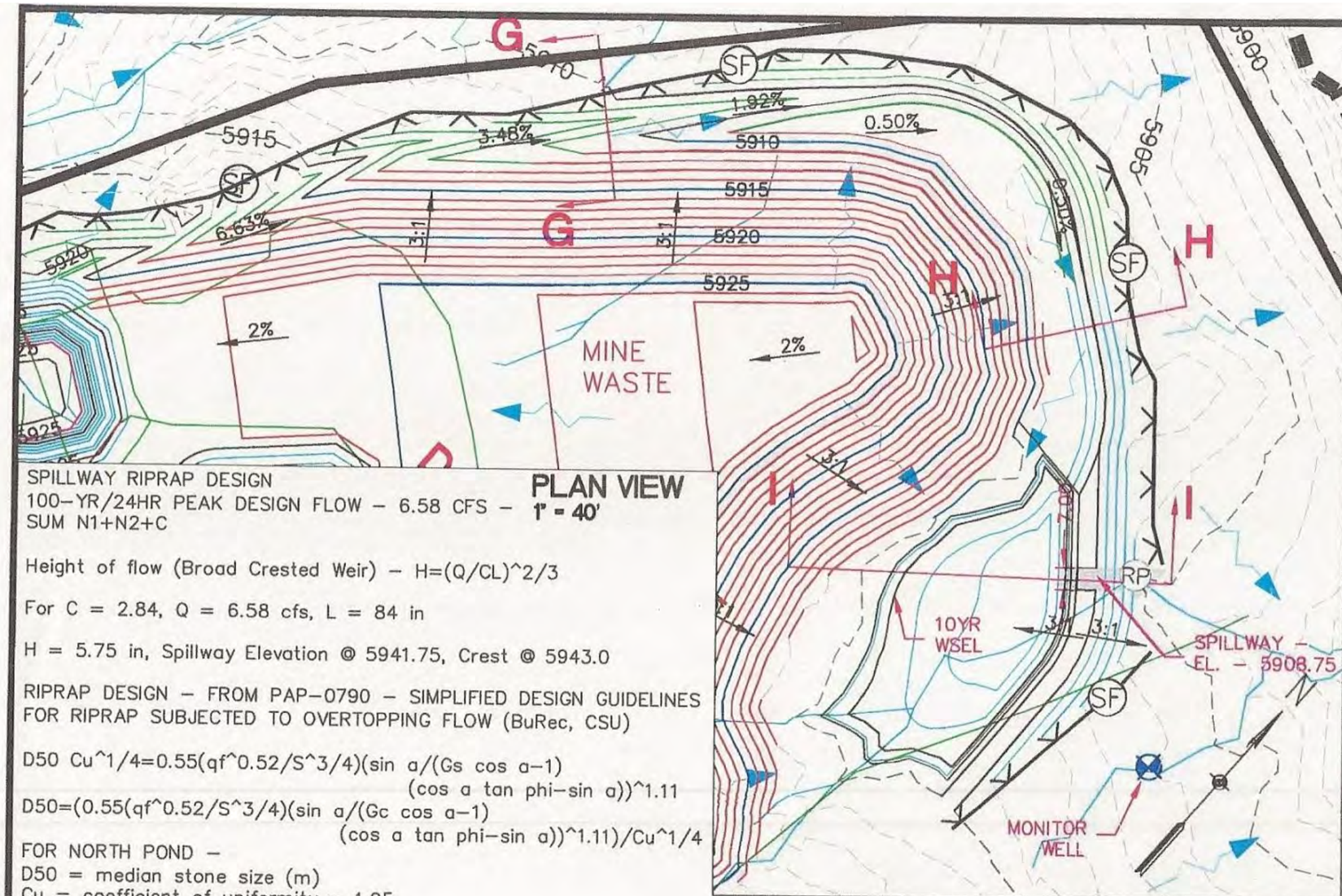
RIMROCK EXPLORATION & DEVELOPMENT

PRINCE ALBERT MINE - 110D PERMIT APPLICATION

EXHIBIT A-3 - STRUCTURES 2

Surface Water Control and Containment Facilities

DATE: 6/14/12 | JAMES C. PIERCE, JR.



PLAN VIEW
1" = 40'

SPILLWAY RIPRAP DESIGN
100-YR/24HR PEAK DESIGN FLOW - 6.58 CFS - SUM N1+N2+C

Height of flow (Broad Crested Weir) - H=(Q/CL)^2/3

For C = 2.84, Q = 6.58 cfs, L = 84 in

H = 5.75 in, Spillway Elevation @ 5941.75, Crest @ 5943.0

RIPRAP DESIGN - FROM PAP-0790 - SIMPLIFIED DESIGN GUIDELINES FOR RIPRAP SUBJECTED TO OVERTOPPING FLOW (BuRec, CSU)

D50 Cu^1/4=0.55(qf^0.52/S^3/4)(sin a/(Gs cos a-1)
(cos a tan phi-sin a))^1.11

D50=(0.55(qf^0.52/S^3/4)(sin a/(Gc cos a-1)
(cos a tan phi-sin a))^1.11)/Cu^1/4

FOR NORTH POND -
D50 = median stone size (m)
Cu = coefficient of uniformity = 1.95,
qf = unit discharge (m3/m/s) = 0.087
S = embankment slope (unitless) = 0.333,
a = embankment slope (degrees) = 18.43
Gs = specific gravity of riprap = 2.24,
phi = angle of repose of the riprap = 42

D50 = 0.145M use 6.0in

For interstitial flow, Vi (flow velocity) = (gD50)^0.5*2.48s^0.58*CU^-2.22
where s = slope in ft per ft = 0.333
Vi = (32.16x(6/12))^0.5x(2.48x(0.333)^0.58)x(1.95^-2.22) = 1.194 fps
Average velocity is the interstitial velocity multiplied by the porosity (Np) of the riprap - Vav = Vi x Np.

for Np = 0.45, Vav = 1.194x0.45 = 0.537 fps.
Depth of flow is the flow quantity divided by the average velocity -
Y = Q/Vav, Y = (6.58/7ft.)/0.537fps = 1.75 ft. or 21.0 in. using

To provide a safety factor use a riprap with a D50 of 9.0 in.

Vi = (32.16x(9/12))^0.5x(2.48x(0.333)^0.58)x(1.95^-2.22) = 1.46 fps
Vav = 1.46x0.45 = 0.66 fps.
Y = (6.58cfs/7ft)/0.66fps = 1.43 ft or 17.15 in, using an integer multiple of D50 for thickness gives 2xD50 for 18 inches of 9 in D50 riprap.

DETENTION POND 10 YR/24-HR DESIGN VOLUME -

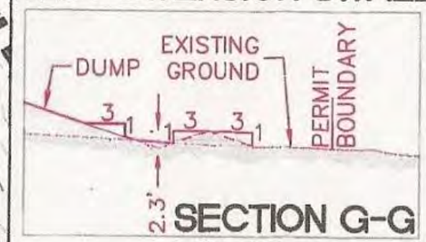
BASIN	AREA	CN	D10	VOLUME	
PA-N1	0.41	88	0.941	1,402	
PA-N2	0.56	89	1.003	2,039	TOTAL - 3,441

VOLUME PROVIDED @ ELEVATION 5908.75 - 3926.5

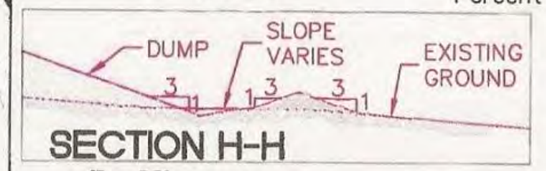
DETENTION POND 100 YR/24-HR DESIGN VOLUME -
(RAISED SPILLWAY)

BASIN	AREA	CN	D10	VOLUME
PA-N1	0.41	88	1.792	2,666

WEST DIVERSION SWALE



SECTION G-G
1" = 20'



SECTION H-H
1" = 20'

100-YR PEAK DESIGN FLOW
SUB-BASIN PA-N1 - 1.13 CFS

Channel Data:

Flowrate	1.13 cfs
Manning's n	0.0280
Slope	0.0663 ft/ft
Height	24.0 in
Left slope	0.33 ft/ft (V/H)
Right slope	0.33 ft/ft (V/H)
Depth	3.76 in
Velocity	3.83 fps
Percent full	15.67 %

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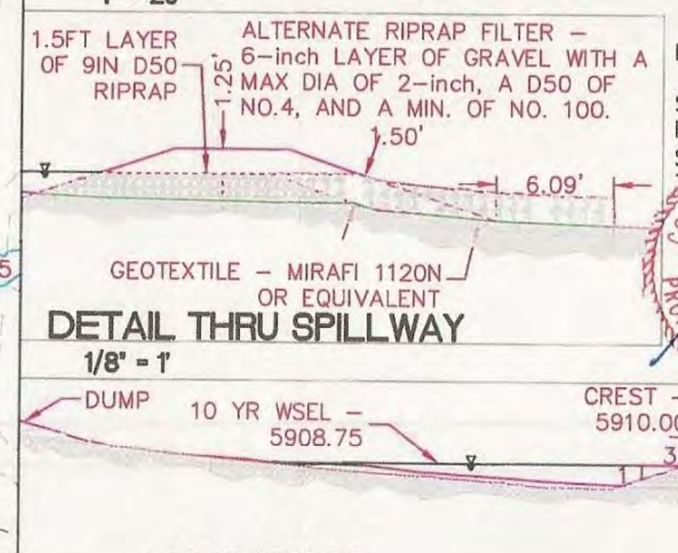
RECLAMATION MINING & SAFETY

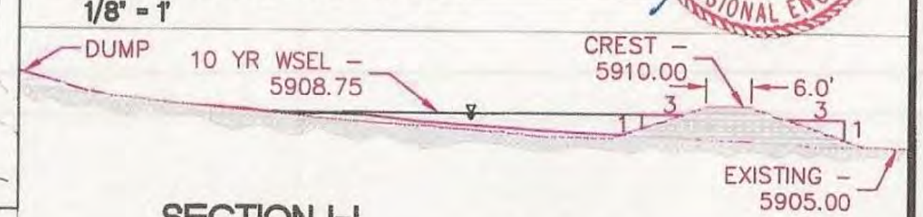


DETAIL THRU SPILLWAY
1/8" = 1'

NOTE -

SEE SHEET U-5 FOR TYPICAL SETIONS (LATERAL) THRU SPILLWAY

COLORADO REGISTERED PROFESSIONAL ENGINEER
STEPHEN C. [illegible]
36736



SECTION I-I
1" = 20'

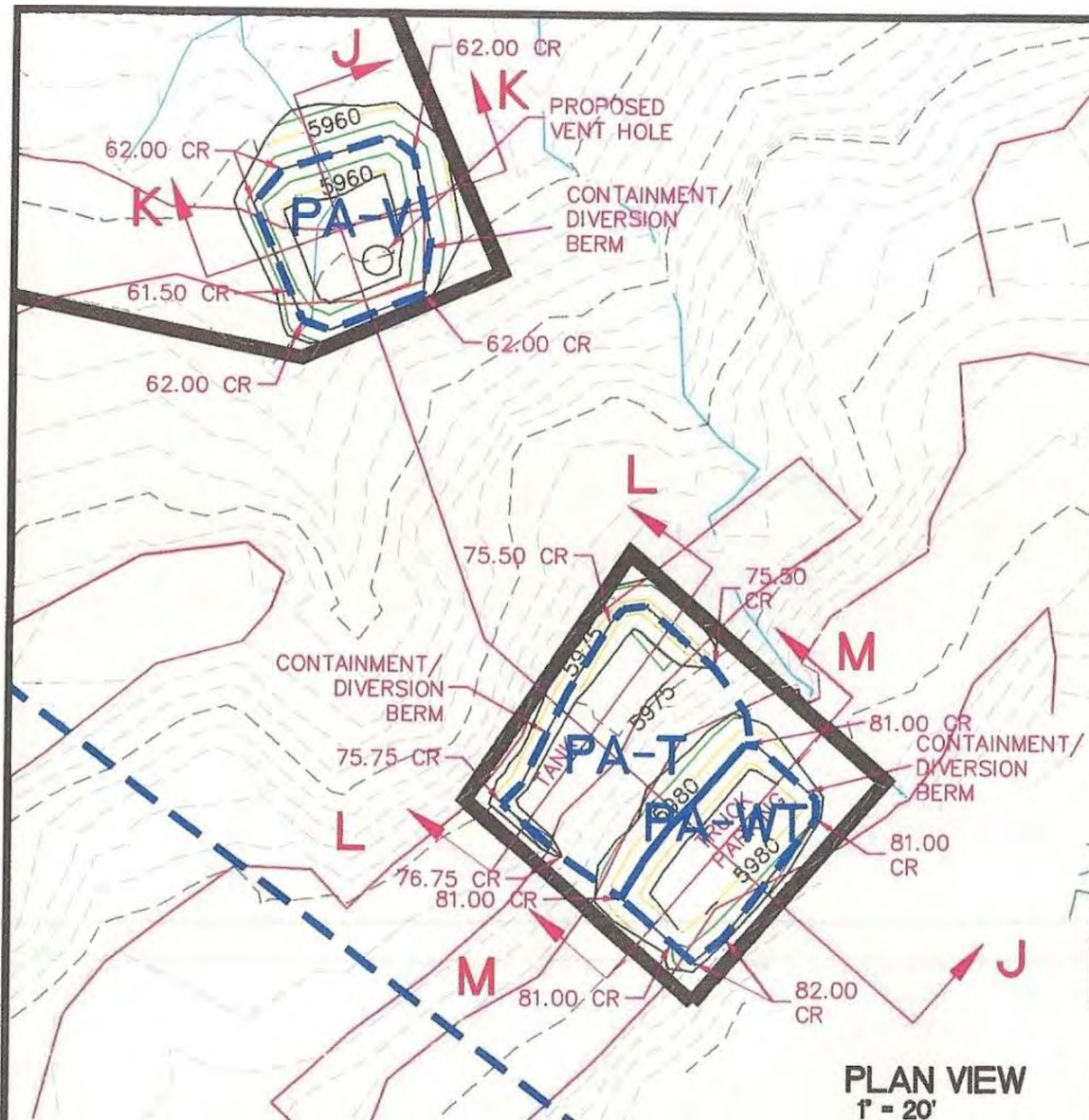
NORTH DETENTION

NORTH DETENTION POND DESIGN VOLUMES -

ELEVATION	AREA	VOLUME (CONIC)
5909.33	4506.63	6370.0
5909.0	4221.22	4915.6
5908.75	3697.25	3926.5
5908.0	2371.78	1668.9
5907.0	1053.97	0.0

RIMROCK EXPLORATION & DEVELOPMENT
PRINCE ALBERT MINE - 110D PERMIT APPLICATION
EXHIBIT A-4 - STRUCTURES 3
Surface Water Control and Containment Facilities

DATE: 6/14/12 | JAMES C. PIERCE, JR.

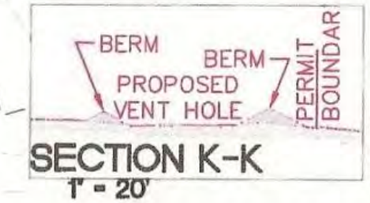


PLAN VIEW
1" = 20'

BOREHOLE/SERVICE DROP DETENTION/DIVERSION

VENT BORE HOLE DETENTION DESIGN VOLUME –

BASIN	AREA	C10	D10	VOLUME
PA–V	0.010	0.63	1.97	46.6

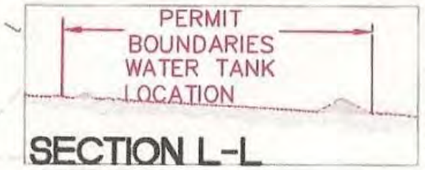


VOLUME PROVIDED @ ELEVATION –

ELEVATION	AREA (SF)	VOLUME (CF)
5961.5	392.0	411.0
5961.0	322.3	233.2
5960.0	156.8	0.0

WATER TANK BASIN 10–YR/24 HR DESIGN VOLUME –

BASIN	AREA	C10	D10	VOLUME
PA–T	0.016	0.63	1.97	74.3

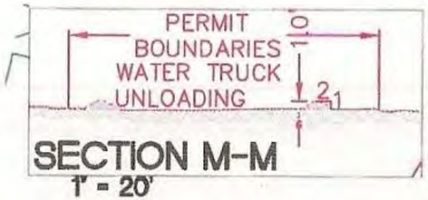


VOLUME PROVIDED @ ELEVATION –

ELEVATION (FT)	AREA (SF)	VOLUME (CF)
5975.5	321.2	194.4
5975.0	143.9	81.1
5974.5	93.7	22.1
5974.0	9.4	0.0

WATER TRUCK DUMP STATION 10–YR/24 HR DESIGN VOLUME –

BASIN	AREA	C10	D10	VOLUME
PA–WT	0.009	0.63	1.97	41.5



VOLUME PROVIDED @ ELEVATION –

ELEVATION (FT)	AREA (SF)	VOLUME (CF)
5981.0	369.00	339.2
5980.5	293.28	174.0
5980.0	225.46	44.6
5979.5	5.90	0.0

RIPRAP SPECIFICATION –

1. Riprap is to be well cemented sandstone or conglomerate with a minimum Specific Gravity of 2.24 (139 pcf).
2. Riprap will be free of shale or shale inclusions or visible fractures.
3. Maximum riprap stone size will be 2xD50.
4. For riprap embankment protection the porosity of the layer will be 0.45.
5. Riprap shall be angular with approximately equal Length, Width, and Depth dimensions – maximum ratio of any dimension to another shall not exceed 3.0.
6. Stones selected for riprap will produce a "jagged" appearance when placed in the embankment.

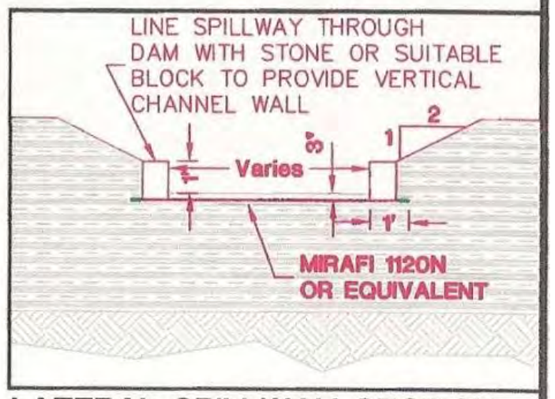
OREPAD POND OVERFLOW TO PORTAL

Given Input Data:

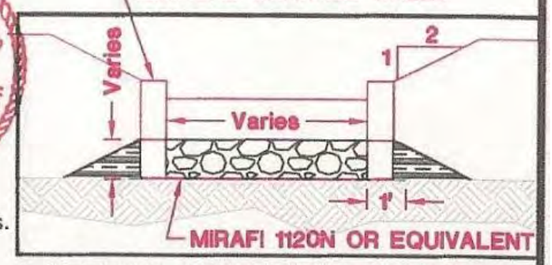
Flowrate	1.11 cfs
Slope	0.005 ft/ft
Manning's n	0.0300
Height	6.0 in
Bottom width	96.0 in
Left slope	0.50 ft/ft (V/H)
Right slope	0.50 ft/ft (V/H)

Computed Results:

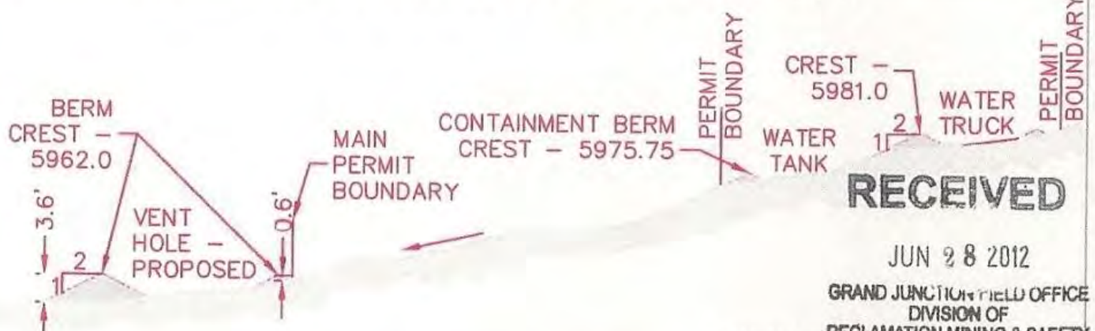
Depth	1.72 in
Velocity	0.93 fps
Percent full	28.70 %



LATERAL SPILLWAY SECTION (typ.,) 1/4" = 1'



LATERAL SPILLWAY SECTION AT TOE (typ.,) 1/4" = 1'



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DIVISION OF
RECLAMATION, MINING & SAFETY

COLORADO REGISTERED PROFESSIONAL ENGINEER
STEVEN C. CUMMINGS
25736
6/26/12

RIMROCK EXPLORATION & DEVELOPMENT	
PRINCE ALBERT MINE - 110D PERMIT APPLICATION	
EXHIBIT A-5 - STRUCTURES 4	
Surface Water Control and Containment Facilities	
DATE: 6/14/12	JAMES C. PIERCE, JR.

Exhibit U

Attachment U.8.3

Prince Albert Mine

Surface Water Controls

Prince Albert Mine

Surface Water Controls Construction Schedule

The construction schedule for the Prince Albert Mine surface water control structures is designed to ensure that an adequate system of surface water control is in place at all times during the life of the mine. This schedule establishes a series of construction milestones that must be met as work progresses under the mining plan. The construction schedule is event driven and not tied to particular calendar dates.

Note: Please refer to the Exhibit **A**, Attachment **A**.8.2, Exhibit **A**-1 through **A**-5 Surface Water Control and Containment Facilities drawings for construction details.

Milestone 1: All work under this milestone is to be completed prior to the deposition on the surface of any new waste rock materials mined from the underground workings under the Limited Impact 110(d) permit.

- Construct East and West Diversion Swales – The diversion swales labeled DS on the construction drawings will be constructed.
- Install North and West Silt Fencing – The silt fencing (labeled SF on the construction drawings) that must be installed from the location labeled Existing Container to the location labeled North Pond will be installed.
- Complete Central Pond – The detention pond identified as the Central Pond on the construction drawings will be completed. The initial containment structure was completed as part of the Bulk Sample NOI. The pond bank will be extended south to the primary magazine location and the pond construction will be completed in accordance with the construction drawings.
- Construct Temporary Diversion Ditch/Berms – A series of temporary surface water diversion ditches and / or berms will be constructed to route direct precipitation surface runoff from the area north of the location labeled Portal and Service Area to the North Pond location. These temporary diversions will be constructed along the toe of the existing surface-deposited waste rock materials to collect and route runoff to the North Pond using existing natural drainage paths. These temporary diversions will be relocated to always remain in

Prince Albert Mine

Surface Water Controls Construction Schedule

Milestone 4: All work under this milestone is to be completed prior to the deposition on the surface of any new ore materials mined from the underground workings under the 110(d) permit.

- Finalize Construction of the Ore Pad Pond – The construction of the containment structure identified as the Ore Pad Pond in the construction drawings was largely completed under the Bulk Sample NOI. The existing structure will be checked for completeness and finished to the final configuration specified on the construction drawings, if necessary.

Milestone 5: Silt fencing will be installed around the planned down-gradient footprint of the Topsoil Stockpile prior to the first placement of growth material at the Topsoil Stockpile location.

Milestone 6: All work under this milestone is to be completed prior to the deposition on the surface at the Secondary Waste Dump location of any new waste rock materials mined from the underground workings under the 110(d) permit.

- Install Silt Fencing – The silt fence (labeled SF on the construction drawings) running south from the location labeled Existing Container to its terminus point west of the Secondary Waste Dump will be installed.
- Construct South Pond – The pond labeled as South Pond on the construction drawings will be constructed using waste rock excavated from outside the uranium-mineralized zone. The bank material will be pushed over the top of the cleaned ore pad location and used as part of the final ore pad cover material at the time of final site reclamation.

Exhibit A

Appendix B

Prince Albert Mine

NRCS

United States Department of Agriculture

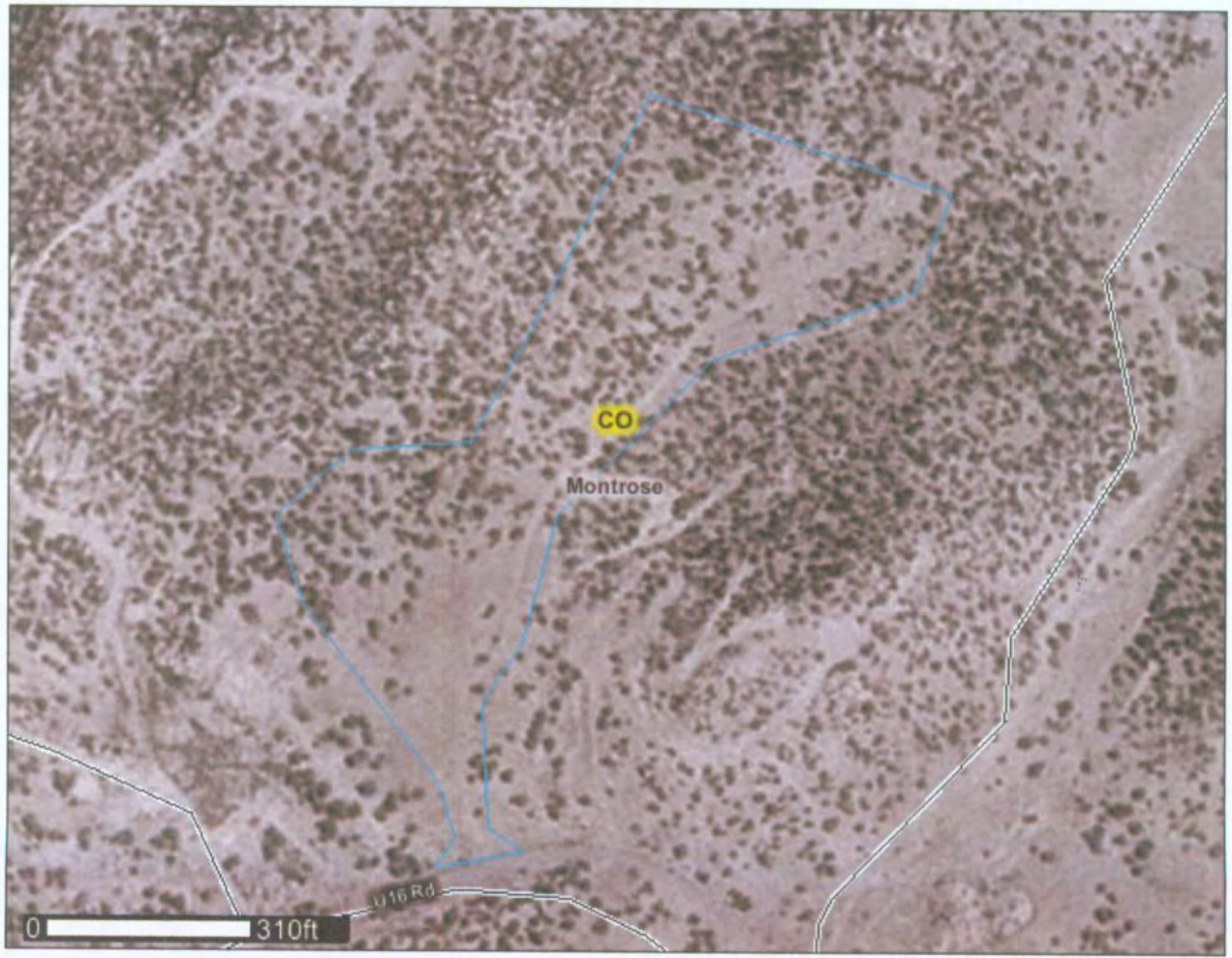
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for San Miguel Area, Colorado, Parts of Dolores, Montrose, and San Miguel Counties

Prince Albert Mine Site



Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://soils.usda.gov/sqi/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (http://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://soils.usda.gov/contact/state_offices/).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Soil Data Mart Web site or the NRCS Web Soil Survey. The Soil Data Mart is the data storage site for the official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the

individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

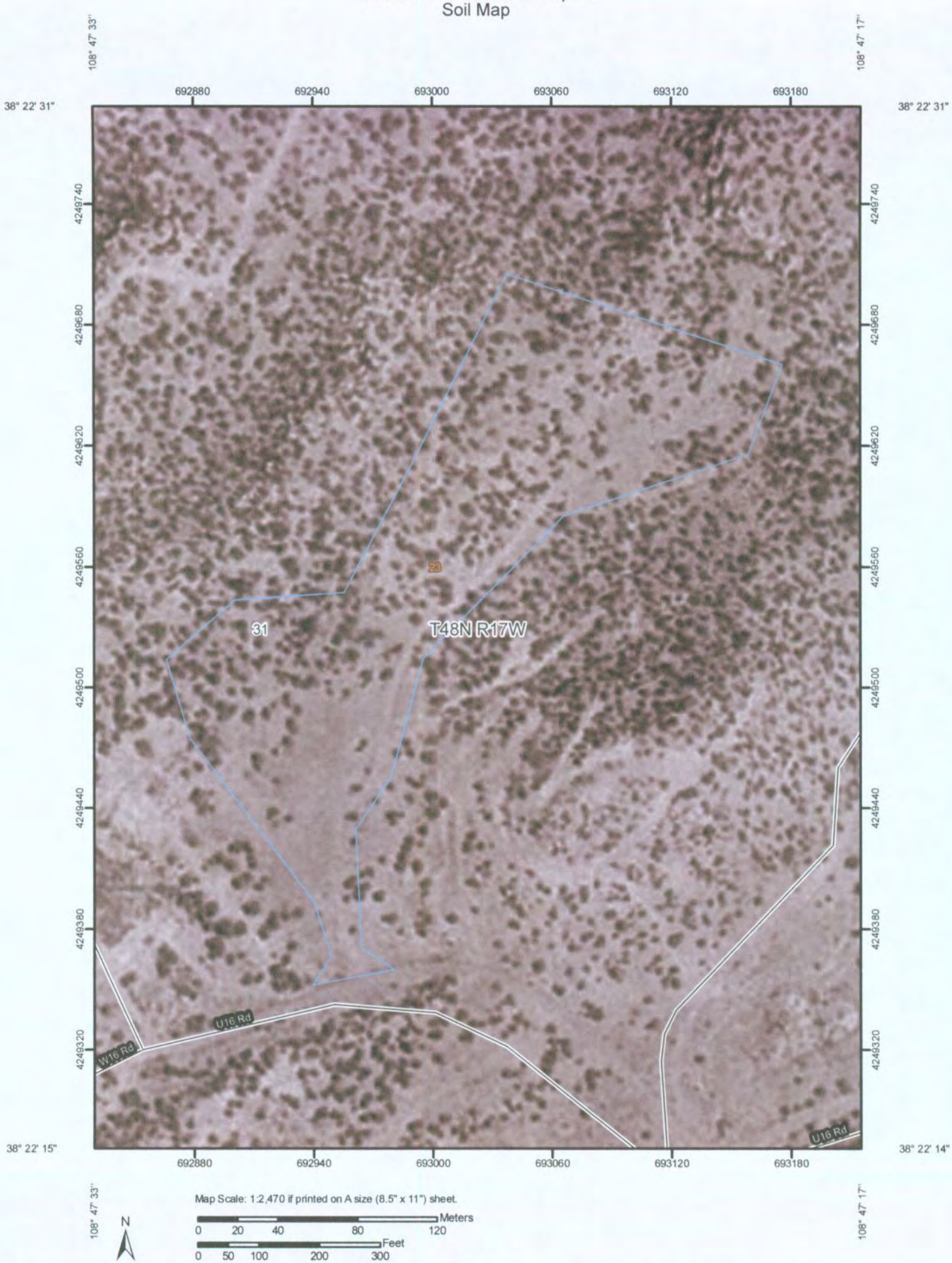
Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Units

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features

- Gully
- Short Steep Slope
- Other

Political Features

- Cities
- PLSS Township and Range
- PLSS Section

Water Features

- Oceans
- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:2,470 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 12N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: San Miguel Area, Colorado, Parts of Dolores, Montrose, and San Miguel Counties
Survey Area Data: Version 6, Feb 1, 2008

Date(s) aerial images were photographed: 7/1/1993

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

San Miguel Area, Colorado, Parts of Dolores, Montrose, and San Miguel Counties (CO675)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
23	Bodot, dry-Ustic Torriorthents complex, 5 to 50 percent slopes	9.2	100.0%
Totals for Area of Interest		**9.2**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

San Miguel Area, Colorado, Parts of Dolores, Montrose, and San Miguel Counties

23—Bodot, dry-Ustic Torriorthents complex, 5 to 50 percent slopes

Map Unit Setting

Elevation: 5,400 to 6,800 feet
Mean annual precipitation: 10 to 12 inches
Mean annual air temperature: 46 to 48 degrees F
Frost-free period: 110 to 130 days

Map Unit Composition

Bodot, dry, and similar soils: 45 percent
Ustic torriorthents and similar soils: 40 percent
Minor components: 15 percent

Description of Bodot, Dry

Setting

Landform: Terraces, structural benches, landslides
Landform position (three-dimensional): Tread, riser
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Residuum weathered from shale

Properties and qualities

Slope: 5 to 50 percent
Surface area covered with cobbles, stones or boulders: 5.0 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately high (0.00 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 10 percent
Maximum salinity: Nonsaline to slightly saline (2.0 to 8.0 mmhos/cm)
Sodium adsorption ratio, maximum: 10.0
Available water capacity: Low (about 4.0 inches)

Interpretive groups

Land capability (nonirrigated): 7e
Ecological site: Basin Shale (R035XY408CO)

Typical profile

0 to 3 inches: Cobbly clay loam
3 to 30 inches: Cobbly silty clay
30 to 34 inches: Weathered bedrock

Description of Ustic Torriorthents

Setting

Landform: Structural benches, landslides, terraces
Landform position (three-dimensional): Riser, tread
Down-slope shape: Linear

Across-slope shape: Linear
Parent material: Residuum weathered from sandstone and shale

Properties and qualities

Slope: 5 to 50 percent
Depth to restrictive feature: 10 to 80 inches to lithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum content: 15 percent
Maximum salinity: Nonsaline (0.0 to 2.0 mmhos/cm)
Available water capacity: Low (about 3.7 inches)

Interpretive groups

Land capability (nonirrigated): 7e

Typical profile

0 to 4 inches: Very bouldery clay loam
4 to 31 inches: Cobbly clay loam
31 to 35 inches: Unweathered bedrock

Minor Components

Rock outcrop

Percent of map unit: 10 percent

Pinon

Percent of map unit: 3 percent

Bowdish

Percent of map unit: 2 percent

Soil Information for All Uses

Soil Reports

The Soil Reports section includes various formatted tabular and narrative reports (tables) containing data for each selected soil map unit and each component of each unit. No aggregation of data has occurred as is done in reports in the Soil Properties and Qualities and Suitabilities and Limitations sections.

The reports contain soil interpretive information as well as basic soil properties and qualities. A description of each report (table) is included.

AOI Inventory

This folder contains a collection of tabular reports that present a variety of soil information. Included are various map unit description reports, special soil interpretation reports, and data summary reports.

Component Legend

This report presents general information about the map units and map unit components in the selected area. It shows map unit symbols and names and the components in each map unit. It also shows the percent of the components in the map units, the kind of component, and the slope range of each component.

Report—Component Legend

Component Legend– San Miguel Area, Colorado, Parts of Dolores, Montrose, and San Miguel Counties						
Map unit symbol and name	Pct. of map unit	Component name	Component kind	Pct. slope		
				Low	RV	High
23—Bodot, dry-Ustic Torriorthents complex, 5 to 50 percent slopes						
	45	Bodot, dry	Series	5	28	50
	40	Ustic torriorthents	Taxon above family	5	28	50
	10	Rock outcrop	Miscellaneous area			
	3	Pinon	Series			
	2	Bowdish	Series			

Map Unit Description (Brief, Generated)

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this report, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

The Map Unit Description (Brief, Generated) report displays a generated description of the major soils that occur in a map unit. Descriptions of non-soil (miscellaneous areas) and minor map unit components are not included. This description is generated from the underlying soil attribute data.

Additional information about the map units described in this report is available in other Soil Data Mart reports, which give properties of the soils and the limitations, capabilities, and potentials for many uses. Also, the narratives that accompany the Soil Data Mart reports define some of the properties included in the map unit descriptions.

Report—Map Unit Description (Brief, Generated)

San Miguel Area, Colorado, Parts of Dolores, Montrose, and San Miguel Counties

Map Unit: 23—Bodot, dry-Ustic Torriorthents complex, 5 to 50 percent slopes

Component: Bodot, dry (45%)

The Bodot, dry component makes up 45 percent of the map unit. Slopes are 5 to 50 percent. This component is on terraces, structural benches, landslides. The parent material consists of residuum weathered from shale. Depth to a root restrictive layer, bedrock, paralithic, is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately low. Available water to a depth of 60 inches is low. Shrink-swell potential is high. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. This component is in the R035XY408CO Basin Shale ecological site. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 7 percent. The soil has a slightly saline horizon within 30 inches of the soil surface. The soil has a slightly sodic horizon within 30 inches of the soil surface.

Component: Ustic Torriorthents (40%)

The Ustic Torriorthents component makes up 40 percent of the map unit. Slopes are 5 to 50 percent. This component is on structural benches, landslides, terraces. The parent material consists of residuum weathered from sandstone and shale. Depth to a root restrictive layer, bedrock, lithic, is 10 to 80 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is high. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 1 percent. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria. The calcium carbonate equivalent within 40 inches, typically, does not exceed 8 percent.

Component: Rock outcrop (10%)

Generated brief soil descriptions are created for major components. The Rock outcrop soil is a minor component.

Component: Pinon (3%)

Generated brief soil descriptions are created for major components. The Pinon soil is a minor component.

Component: Bowdish (2%)

Generated brief soil descriptions are created for major components. The Bowdish soil is a minor component.

Construction Materials

This folder contains a collection of tabular reports that present soil interpretations related to sources of construction materials. The reports (tables) include all selected

map units and components for each map unit, limiting features and interpretive ratings. Construction materials interpretations are tools designed to provide guidance to users in selecting a site for potential source of various materials. Individual soils or groups of soils may be selected as a potential source because they are close at hand, are the only source available, or they meets some or all of the physical or chemical properties required for the intended application. Example interpretations include roadfill, sand and gravel, topsoil and reclamation material.

Source of Reclamation Material, Roadfill, and Topsoil

This table gives information about the soils as potential sources of reclamation material, roadfill, and topsoil. Normal compaction, minor processing, and other standard construction practices are assumed.

The soils are rated *good*, *fair*, or *poor* as potential sources of reclamation material, roadfill, and topsoil. The features that limit the soils as sources of these materials are specified in the table. Numerical ratings between 0.00 and 0.99 are given after the specified features. These numbers indicate the degree to which the features limit the soils as sources of topsoil, reclamation material, or roadfill. The lower the number, the greater the limitation.

Reclamation material is used in areas that have been drastically disturbed by surface mining or similar activities. When these areas are reclaimed, layers of soil material or unconsolidated geological material, or both, are replaced in a vertical sequence. The reconstructed soil favors plant growth. The ratings in the table do not apply to quarries and other mined areas that require an offsite source of reconstruction material. The ratings are based on the soil properties that affect erosion and stability of the surface and the productive potential of the reconstructed soil. These properties include the content of sodium, salts, and calcium carbonate; reaction; available water capacity; erodibility; texture; content of rock fragments; and content of organic matter and other features that affect fertility.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments. The ratings are for the whole soil, from the surface to a depth of about 5 feet. It is assumed that soil layers will be mixed when the soil material is excavated and spread.

The ratings are based on the amount of suitable material and on soil properties that affect the ease of excavation and the performance of the material after it is in place. The thickness of the suitable material is a major consideration. The ease of excavation is affected by large stones, depth to a water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the AASHTO classification of the soil) and linear extensibility (shrink-swell potential).

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area. The ratings are based on the soil properties that affect plant growth; the ease of excavating, loading, and spreading the material; and reclamation of the borrow area. Toxic substances, soil reaction, and the properties that are inferred from soil texture, such as available water capacity and fertility, affect plant growth. The ease of excavating, loading, and spreading is affected by rock fragments, slope, depth to a water table, soil texture, and thickness of suitable

material. Reclamation of the borrow area is affected by slope, depth to a water table, rock fragments, depth to bedrock or a cemented pan, and toxic material.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Information in this table is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil between the surface and a depth of 5 to 7 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this table. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Report—Source of Reclamation Material, Roadfill, and Topsoil

[Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.00 to 0.99. The smaller the value, the greater the limitation]

Source of Reclamation Material, Roadfill, and Topsoil– San Miguel Area, Colorado, Parts of Dolores, Montrose, and San Miguel Counties							
Map symbol and soil name	Pct. of map unit	Potential as a source of reclamation material		Potential as a source of roadfill		Potential as a source of topsoil	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
23—Bodot, dry-Ustic Torriorthents complex, 5 to 50 percent slopes							
Bodot, dry	45	Poor		Poor		Poor	
		Too clayey	0.00	Depth to bedrock	0.00	Too clayey	0.00
		Organic matter content low	0.12	Low strength	0.00	Rock fragments	0.02
		Droughty	0.23	Shrink-swell	0.12	Slope	0.00
		Too alkaline	0.00	Slope	0.00	Depth to bedrock	0.54
		Depth to bedrock	0.54	Cobble content	0.69	Salinity	0.88
Ustic torriorthents	40	Fair		Poor		Poor	
		Droughty	0.14	Shrink-swell	0.12	Slope	0.00
		Organic matter content low	0.12	Depth to bedrock	0.00	Too clayey	0.01
		Too clayey	0.02	Slope	0.00	Rock fragments	0.12
		Depth to bedrock	0.65	Low strength	0.00	Depth to bedrock	0.65
		Stone content	0.83	Stones	0.83		

Land Classifications

This folder contains a collection of tabular reports that present a variety of soil groupings. The reports (tables) include all selected map units and components for each map unit. Land classifications are specified land use and management groupings that are assigned to soil areas because combinations of soil have similar behavior for specified practices. Most are based on soil properties and other factors that directly influence the specific use of the soil. Example classifications include ecological site classification, farmland classification, irrigated and nonirrigated land capability classification, and hydric rating.

Land Capability Classification

The land capability classification of map units in the survey area is shown in this table. This classification shows, in a general way, the suitability of soils for most kinds of field crops (United States Department of Agriculture, Soil Conservation Service, 1961). Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but

unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for rangeland, for forestland, or for engineering purposes.

In the capability system, soils are generally grouped at three levels: capability class, subclass, and unit.

Capability classes, the broadest groups, are designated by the numbers 1 through 8. The numbers indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

- Class 1 soils have slight limitations that restrict their use.
- Class 2 soils have moderate limitations that restrict the choice of plants or that require moderate conservation practices.
- Class 3 soils have severe limitations that restrict the choice of plants or that require special conservation practices, or both.
- Class 4 soils have very severe limitations that restrict the choice of plants or that require very careful management, or both.
- Class 5 soils are subject to little or no erosion but have other limitations, impractical to remove, that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.
- Class 6 soils have severe limitations that make them generally unsuitable for cultivation and that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.
- Class 7 soils have very severe limitations that make them unsuitable for cultivation and that restrict their use mainly to grazing, forestland, or wildlife habitat.
- Class 8 soils and miscellaneous areas have limitations that preclude commercial plant production and that restrict their use to recreational purposes, wildlife habitat, watershed, or esthetic purposes.

Capability subclasses are soil groups within one class. They are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, 2e. The letter *e* shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class 1 there are no subclasses because the soils of this class have few limitations. Class 5 contains only the subclasses indicated by *w*, *s*, or *c* because the soils in class 5 are subject to little or no erosion.

Report—Land Capability Classification

Land Capability Classification– San Miguel Area, Colorado, Parts of Dolores, Montrose, and San Miguel Counties				
Map unit symbol and name	Pct. of map unit	Component name	Land Capability Subclass	
			Nonirrigated	Irrigated
23—Bodot, dry-Ustic Torriorthents complex, 5 to 50 percent slopes				
	45	Bodot, dry	7e	—
	40	Ustic torriorthents	7e	—

Taxonomic Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (Soil Survey Staff, 1999 and 2003). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. This table shows the classification of the soils in the survey area. The categories are defined in the following paragraphs.

ORDER. Twelve soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Alfisols.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Udalfs (*Ud*, meaning humid, plus *alfs*, from Alfisols).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; type of saturation; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Hapludalfs (*Hapl*, meaning minimal horizonation, plus *udalfs*, the suborder of the Alfisols that has a udic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic subgroup is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other taxonomic class. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Hapludalfs.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class,

mineralogy class, cation-exchange activity class, soil temperature regime, soil depth, and reaction class. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-loamy, mixed, active, mesic Typic Hapludalfs.

SERIES. The series consists of soils within a family that have horizons similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile.

References:
Soil Survey Staff. 1999. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. 2nd edition. Natural Resources Conservation Service. U.S. Department of Agriculture Handbook 436.
Soil Survey Staff. 2006. Keys to soil taxonomy. 10th edition. U.S. Department of Agriculture, Natural Resources Conservation Service. (The soils in a given survey area may have been classified according to earlier editions of this publication.)

Report—Taxonomic Classification of the Soils

[An asterisk by the soil name indicates a taxadjunct to the series]

Taxonomic Classification of the Soils– San Miguel Area, Colorado, Parts of Dolores, Montrose, and San Miguel Counties	
Soil name	**Family or higher taxonomic classification**
Bodot	Fine, montmorillonitic (calcareous), mesic Ustic Torriorthents
Ustic Torriorthents	Ustic Torriorthents

Land Management

This folder contains a collection of tabular reports that present soil interpretations related to land management. The reports (tables) include all selected map units and components for each map unit, limiting features and interpretive ratings. Land management interpretations are tools designed to guide the user in evaluating existing conditions in planning and predicting the soil response to various land management practices, for a variety of land uses, including cropland, forestland, hayland, pastureland, horticulture, and rangeland. Example interpretations include suitability for a variety of irrigation practices, log landings, haul roads and major skid trails, equipment operability, site preparation, suitability for hand and mechanical planting, potential erosion hazard associated with various practices, and ratings for fencing and waterline installation.

Rangeland Seeding and Rangeland Drill

This table can help rangeland owners or managers plan the use of soils for range production and management. Interpretive ratings are given for the soils according to the limitations that affect various aspects of rangeland management.

The ratings are both verbal and numerical. Numerical ratings in the table indicate the degree to which individual soil properties affect the suitability of each soil for the indicated use. The numerical ratings are shown as decimal fractions ranging from 0.00 to 1.00. They indicate gradations between the point at which a soil feature has the

greatest negative impact on the specified aspect of rangeland management (0.00) and the point at which the soil feature is not a limitation (1.00).

The ratings for *Rangeland seeding (Colorado Plateau)* and *Rangeland seeding (Great Basin)* are based on precipitation, soil depth, salinity, and sodium adsorption ratio. The soils are described as being well suited, moderately suited, or poorly suited. A rating of *well suited* indicates that no significant limitations affect the activity, *moderately suited* indicates that one or more limitations can cause some difficulty, and *poorly suited* indicates that one or more limitations can make the seeding operation and its success very difficult. The overall rating class for each soil is assigned based on the product of the numerical ratings of the individual soil properties considered in the interpretation.

The ratings for *rangeland drill* are based on rock fragments on or in the soil, slope, texture, ponding, flooding, and depth to a water table. The soils are described as being well suited, moderately suited, or poorly suited. A rating of *well suited* indicates that no significant limitations affect the activity, *moderately suited* indicates that one or more limitations can cause some difficulty, and *poorly suited* indicates that one or more limitations can make the use of a rangeland drill very difficult. The overall rating class for each soil is assigned based on the product of the numerical ratings of the individual soil properties considered in the interpretation.

Report—Rangeland Seeding and Rangeland Drill

[Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.0 to 0.99. The smaller the value, the greater the limitation. The table shows only the top five limitations for any given soil. The soil may have additional limitations]

Rangeland Seeding and Rangeland Drill– San Miguel Area, Colorado, Parts of Dolores, Montrose, and San Miguel Counties							
Map symbol and soil name	Pct. of map unit	Rangeland seeding (Colorado Plateau)		Rangeland seeding (Great Basin)		Rangeland drill	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
23—Bodot, dry-Ustic Torriorthents complex, 5 to 50 percent slopes							
Bodot, dry	45	Moderately suited		Moderately suited		Poorly suited	
		Moderately suited for precipitation	0.96	Moderately suited for precipitation	0.26	Poorly suited for fragments >2mm	0.00
		Moderately suited for depth	0.80	Moderately suited for salinity	0.88	Poorly suited for slope	0.00
		Moderately suited for salinity	0.88			Poorly suited for fragment cover	0.00
Ustic torriorthents	40	Moderately suited		Moderately suited		Poorly suited	
		Moderately suited for precipitation	0.96	Moderately suited for precipitation	0.26	Poorly suited for fragments >2mm	0.00
		Moderately suited for depth	0.84			Poorly suited for slope	0.00

greatest negative impact on the specified aspect of rangeland management (0.00) and the point at which the soil feature is not a limitation (1.00).

The ratings for *Rangeland seeding (Colorado Plateau)* and *Rangeland seeding (Great Basin)* are based on precipitation, soil depth, salinity, and sodium adsorption ratio. The soils are described as being well suited, moderately suited, or poorly suited. A rating of *well suited* indicates that no significant limitations affect the activity, *moderately suited* indicates that one or more limitations can cause some difficulty, and *poorly suited* indicates that one or more limitations can make the seeding operation and its success very difficult. The overall rating class for each soil is assigned based on the product of the numerical ratings of the individual soil properties considered in the interpretation.

The ratings for *rangeland drill* are based on rock fragments on or in the soil, slope, texture, ponding, flooding, and depth to a water table. The soils are described as being well suited, moderately suited, or poorly suited. A rating of *well suited* indicates that no significant limitations affect the activity, *moderately suited* indicates that one or more limitations can cause some difficulty, and *poorly suited* indicates that one or more limitations can make the use of a rangeland drill very difficult. The overall rating class for each soil is assigned based on the product of the numerical ratings of the individual soil properties considered in the interpretation.

Report—Rangeland Seeding and Rangeland Drill

[Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.0 to 0.99. The smaller the value, the greater the limitation. The table shows only the top five limitations for any given soil. The soil may have additional limitations]

Rangeland Seeding and Rangeland Drill– San Miguel Area, Colorado, Parts of Dolores, Montrose, and San Miguel Counties							
Map symbol and soil name	Pct. of map unit	Rangeland seeding (Colorado Plateau)		Rangeland seeding (Great Basin)		Rangeland drill	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
23—Bodot, dry-Ustic Torriorthents complex, 5 to 50 percent slopes							
Bodot, dry	45	Moderately suited		Moderately suited		Poorly suited	
		Moderately suited for precipitation	0.96	Moderately suited for precipitation	0.26	Poorly suited for fragments >2mm	0.00
		Moderately suited for depth	0.80	Moderately suited for salinity	0.88	Poorly suited for slope	0.00
		Moderately suited for salinity	0.88			Poorly suited for fragment cover	0.00
Ustic torriorthents	40	Moderately suited		Moderately suited		Poorly suited	
		Moderately suited for precipitation	0.96	Moderately suited for precipitation	0.26	Poorly suited for fragments >2mm	0.00
		Moderately suited for depth	0.84			Poorly suited for slope	0.00

Rangeland Tillage, Compaction Resistance, and Soil Restoration– San Miguel Area, Colorado, Parts of Dolores, Montrose, and San Miguel Counties							
Map symbol and soil name	Pct. of map unit	Rangeland tillage		Resistance to soil compaction		Soil restoration potential	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
23—Bodot, dry-Ustic Torriorthents complex, 5 to 50 percent slopes							
Bodot, dry	45	Poorly suited		Low resistance		Moderate potential	
		Moderately suited for fragments 75-250mm	0.12	Moderate resistance for clay	0.50	Moderate potential for precipitation	0.84
		Poorly suited for slope	0.00	Moderate resistance for sand	0.65		
		Poorly suited for fragment cover	0.00	Moderate resistance for surface structure size	0.80		
		Moderately suited for clay	0.95	Moderate resistance for surface structure grade	0.90		
				Moderate resistance for surface structure type	0.90		
Ustic torriorthents	40	Poorly suited		Low resistance		Moderate potential	
		Poorly suited for slope	0.00	Moderate resistance for clay	0.55	Moderate potential for precipitation	0.84
		Moderately suited for clay	0.89	Moderate resistance for sand	0.67		
		Moderately suited for fragments 75-250mm	0.96	Moderate resistance for surface structure size	0.80		
				Moderate resistance for range production	0.90		
				Moderate resistance for surface structure grade	0.90		

Soil Chemical Properties

This folder contains a collection of tabular reports that present soil chemical properties. The reports (tables) include all selected map units and components for each map unit. Soil chemical properties are measured or inferred from direct observations in the field or laboratory. Examples of soil chemical properties include pH, cation exchange capacity, calcium carbonate, gypsum, and electrical conductivity.

Chemical Soil Properties

This table shows estimates of some chemical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Cation-exchange capacity is the total amount of extractable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. Soils having a low cation-exchange capacity hold fewer cations and may require more frequent applications of fertilizer than soils having a high cation-exchange capacity. The ability to retain cations reduces the hazard of ground-water pollution.

Effective cation-exchange capacity refers to the sum of extractable cations plus aluminum expressed in terms of milliequivalents per 100 grams of soil. It is determined for soils that have pH of less than 5.5.

Soil reaction is a measure of acidity or alkalinity. It is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Calcium carbonate equivalent is the percent of carbonates, by weight, in the fraction of the soil less than 2 millimeters in size. The availability of plant nutrients is influenced by the amount of carbonates in the soil.

Gypsum is expressed as a percent, by weight, of hydrated calcium sulfates in the fraction of the soil less than 20 millimeters in size. Gypsum is partially soluble in water. Soils that have a high content of gypsum may collapse if the gypsum is removed by percolating water.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Sodium adsorption ratio (SAR) is a measure of the amount of sodium (Na) relative to calcium (Ca) and magnesium (Mg) in the water extract from saturated soil paste. It is the ratio of the Na concentration divided by the square root of one-half of the Ca + Mg concentration. Soils that have SAR values of 13 or more may be characterized by an increased dispersion of organic matter and clay particles, reduced saturated hydraulic conductivity and aeration, and a general degradation of soil structure.

Chemical Soil Properties– San Miguel Area, Colorado, Parts of Dolores, Montrose, and San Miguel Counties								
Map symbol and soil name	Depth	Cation-exchange capacity	Effective cation-exchange capacity	Soil reaction	Calcium carbonate	Gypsum	Salinity	Sodium adsorption ratio
	In	*meq/100g*	*meq/100g*	*pH*	*Pct*	*Pct*	*mmhos/cm*	
23—Bodot, dry-Ustic Torriorthents complex, 5 to 50 percent slopes								
Bodot, dry	0-3	18-23	—	7.9-8.4	5-10	0	0	0
	3-30	19-33	—	8.5-9.0	5-10	0	2.0-8.0	0-10
	30-34	—	—	—	—	—	—	—
Ustic torriorthents	0-4	18-26	—	7.9-8.4	0-15	0	0.0-2.0	0
	4-31	14-35	—	7.9-8.4	0-15	0	0.0-2.0	0
	31-35	—	—	—	—	—	—	—

Soil Erosion

This folder contains a collection of tabular reports that present soil erosion factors and groupings. The reports (tables) include all selected map units and components for each map unit. Soil erosion factors are soil properties and interpretations used in evaluating the soil for potential erosion. Example soil erosion factors can include K factor for the whole soil or on a rock free basis, T factor, wind erodibility group and wind erodibility index.

RUSLE2 Related Attributes

This report summarizes those soil attributes used by the Revised Universal Soil Loss Equation Version 2 (RUSLE2) for the map units in the selected area. The report includes the map unit symbol, the component name, and the percent of the component in the map unit. Soil property data for each map unit component include the hydrologic soil group, erosion factors Kf for the surface horizon, erosion factor T, and the representative percentage of sand, silt, and clay in the surface horizon.

Report—RUSLE2 Related Attributes

RUSLE2 Related Attributes– San Miguel Area, Colorado, Parts of Dolores, Montrose, and San Miguel Counties								
Map symbol and soil name	Pct. of map unit	Slope length (ft)	Hydrologic group	Kf	T factor	Representative value		
						% Sand	% Silt	% Clay
23—Bodot, dry-Ustic Torriorthents complex, 5 to 50 percent slopes								
Bodot, dry	45	—	C	.28	3	35.3	33.2	31.5
Ustic torriorthents	40	—	C	.24	2	34.2	32.3	33.5

Soil Physical Properties

This folder contains a collection of tabular reports that present soil physical properties. The reports (tables) include all selected map units and components for each map unit. Soil physical properties are measured or inferred from direct observations in the field or laboratory. Examples of soil physical properties include percent clay, organic matter, saturated hydraulic conductivity, available water capacity, and bulk density.

Engineering Properties

This table gives the engineering classifications and the range of engineering properties for the layers of each soil in the survey area.

Depth to the upper and lower boundaries of each layer is indicated.

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is 15 percent or more, an appropriate modifier is added, for example, "gravelly."

Classification of the soils is determined according to the Unified soil classification system (ASTM, 2005) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 2004).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to particle-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of particle-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

References:

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487-00.

Absence of an entry indicates that the data were not estimated. The asterisk '*' denotes the representative texture; other possible textures follow the dash.

Engineering Properties– San Miguel Area, Colorado, Parts of Dolores, Montrose, and San Miguel Counties												
Map unit symbol and soil name	Depth	USDA texture	Classification		Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
			Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
	In				*Pct*	*Pct*					*Pct*	
23—Bodot, dry-Ustic Torriorthents complex, 5 to 50 percent slopes												
Bodot, dry	0-3	*Cobbly clay loam	CL	A-6	20-45	20-40	80-100	75-100	65-75	55-70	35-40	15-20
	3-30	*Cobbly silty clay, Silty clay	CH, CL	A-7	0	5-40	80-100	75-100	70-95	65-90	45-60	20-35
	30-34	*Weathered bedrock	—	—	—	—	—	—	—	—	—	—
Ustic torriorthents	0-4	*Very bouldery clay loam	CL	A-6	10-45	5-30	75-90	70-85	65-85	50-70	30-40	10-20
	4-31	*Cobbly clay loam, Clay loam, silty clay loam, clay	CL, CH	A-6, A-7	0-10	0-35	75-95	70-90	65-80	50-70	30-65	10-40
	31-35	*Unweathered bedrock	—	—	—	—	—	—	—	—	—	—

Particle Size and Coarse Fragments

This table shows estimates of particle size distribution and coarse fragment content of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Particle size is the effective diameter of a soil particle as measured by sedimentation, sieving, or micrometric methods. Particle sizes are expressed as classes with specific effective diameter class limits. The broad classes are sand, silt, and clay, ranging from the larger to the smaller.

Sand as a soil separate consists of mineral soil particles that are 0.05 millimeter to 2 millimeters in diameter. In this table, the estimated sand content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Silt as a soil separate consists of mineral soil particles that are 0.002 to 0.05 millimeter in diameter. In this table, the estimated silt content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of sand, silt, and clay affects the physical behavior of a soil. Particle size is important for engineering and agronomic interpretations, for determination of soil hydrologic qualities, and for soil classification.

The amount and kind of clay affect the fertility and physical condition of the soil and the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, saturated hydraulic conductivity (Ksat), plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Total fragments is the content of fragments of rock and other materials larger than 2 millimeters in diameter on volumetric basis of the whole soil.

Fragments 2-74 mm refers to the content of coarse fragments in the 2 to 74 millimeter size fraction.

Fragments 75-249 mm refers to the content of coarse fragments in teh 75 to 249 millimeter size fraction.

Fragments 250-599 mm refers to the content of coarse fragments in the 250 to 599 millimeter size fraction.

Fragments >=600 mm refers to the content of coarse fragments in the greater than or equal to 600 millimeter size fraction.

Reference:
United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. (http://soils.usda.gov)

Particle Size and Coarse Fragments– San Miguel Area, Colorado, Parts of Dolores, Montrose, and San Miguel Counties										
Map symbol and soil name	Horizon	Depth	Sand	Silt	Clay	Total fragments	Fragments 2-74 mm	Fragments 75-249 mm	Fragments 250-599 mm	Fragments >=600 mm
		In	*L-RV-H Pct*	*L-RV-H Pct*	*L-RV-H Pct*	*RV Pct*	*RV Pct*	*RV Pct*	*RV Pct*	*RV Pct*
23—Bodot, dry-Ustic Torriorthents complex, 5 to 50 percent slopes										
Bodot, dry	H1	0-3	-35-	-33-	28-32- 35	32	9	23	—	—
	H2	3-30	- 6-	-47-	40-48- 55	27	12	15	—	—
	H3	30-34	—	—	—	—	—	—	—	—
Ustic Torriorthents	H1	0-4	-34-	-32-	27-34- 40	38	12	10	—	16
	H2	4-31	-30-	-31-	27-39- 60	28	15	10	—	3
	H3	31-35	—	—	—	—	—	—	—	—

Physical Soil Properties

This table shows estimates of some physical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated.

Particle size is the effective diameter of a soil particle as measured by sedimentation, sieving, or micrometric methods. Particle sizes are expressed as classes with specific effective diameter class limits. The broad classes are sand, silt, and clay, ranging from the larger to the smaller.

Sand as a soil separate consists of mineral soil particles that are 0.05 millimeter to 2 millimeters in diameter. In this table, the estimated sand content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Silt as a soil separate consists of mineral soil particles that are 0.002 to 0.05 millimeter in diameter. In this table, the estimated silt content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of sand, silt, and clay affects the physical behavior of a soil. Particle size is important for engineering and agronomic interpretations, for determination of soil hydrologic qualities, and for soil classification.

The amount and kind of clay affect the fertility and physical condition of the soil and the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, saturated hydraulic conductivity (Ksat), plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

Moist bulk density is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3- or 1/10-bar (33kPa or 10kPa) moisture tension. Weight is determined after the soil is dried at 105 degrees C. In the table, the estimated moist bulk density of each soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute linear extensibility, shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. Depending on soil texture, a bulk density of more than 1.4 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Saturated hydraulic conductivity (Ksat) refers to the ease with which pores in a saturated soil transmit water. The estimates in the table are expressed in terms of micrometers per second. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Saturated hydraulic conductivity (Ksat) is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each soil layer. The capacity varies, depending on soil properties that affect retention of water. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Linear extensibility refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. It is an expression of the volume change between the water content of the clod at 1/3- or 1/10-bar tension (33kPa or 10kPa tension) and oven dryness. The volume change is reported in the table as percent change for the whole soil. The amount and type of clay minerals in the soil influence volume change.

Linear extensibility is used to determine the shrink-swell potential of soils. The shrink-swell potential is low if the soil has a linear extensibility of less than 3 percent; moderate if 3 to 6 percent; high if 6 to 9 percent; and very high if more than 9 percent. If the linear extensibility is more than 3, shrinking and swelling can cause damage to buildings, roads, and other structures and to plant roots. Special design commonly is needed.

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In this table, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter. The content of organic matter in a soil can be maintained by returning crop residue to the soil.

Organic matter has a positive effect on available water capacity, water infiltration, soil organism activity, and tilth. It is a source of nitrogen and other nutrients for crops and soil organisms.

Erosion factors are shown in the table as the K factor (Kw and Kf) and the T factor. Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and Ksat. Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor Kw indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.

Erosion factor Kf indicates the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind and/or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their susceptibility to wind erosion in cultivated areas. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible. The groups are described in the "National Soil Survey Handbook."

Wind erodibility index is a numerical value indicating the susceptibility of soil to wind erosion, or the tons per acre per year that can be expected to be lost to wind erosion.

There is a close correlation between wind erosion and the texture of the surface layer, the size and durability of surface clods, rock fragments, organic matter, and a calcareous reaction. Soil moisture and frozen soil layers also influence wind erosion.

Reference:
United States Department of Agriculture, Natural Resources Conservation Service. National soil survey handbook, title 430-VI. (http://soils.usda.gov)

Physical Soil Properties– San Miguel Area, Colorado, Parts of Dolores, Montrose, and San Miguel Counties														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	Pct	Pct	Pct	g/cc	micro m/sec	In/In	Pct	Pct					
23—Bodot, dry-Ustic Torriorthents complex, 5 to 50 percent slopes														
Bodot, dry	0-3	-35-	-33-	28-32- 35	1.25-1.35	1.41-4.23	0.12-0.18	0.0-2.9	0.5-1.0	.10	.28	3	5	56
	3-30	- 6-	-47-	40-48- 55	1.30-1.40	0.42-1.41	0.10-0.15	6.0-8.9	0.0-0.5	.15	.32			
	30-34	—	—	—	—	0.00-14.11	—	—	—					
Ustic torriorthents	0-4	-34-	-32-	27-34- 40	1.25-1.35	1.41-4.23	0.11-0.13	3.0-5.9	0.5-1.0	.10	.24	2	6	48
	4-31	-30-	-31-	27-39- 60	1.25-1.35	1.41-4.23	0.11-0.13	6.0-8.9	0.0-0.5	.15	.28			
	31-35	—	—	—	—	0.42-1.41	—	—	—					

Soil Qualities and Features

This folder contains tabular reports that present various soil qualities and features. The reports (tables) include all selected map units and components for each map unit. Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Soil Features

This table gives estimates of various soil features. The estimates are used in land use planning that involves engineering considerations.

A *restrictive layer* is a nearly continuous layer that has one or more physical, chemical, or thermal properties that significantly impede the movement of water and air through the soil or that restrict roots or otherwise provide an unfavorable root environment. Examples are bedrock, cemented layers, dense layers, and frozen layers. The table indicates the hardness and thickness of the restrictive layer, both of which significantly affect the ease of excavation. *Depth to top* is the vertical distance from the soil surface to the upper boundary of the restrictive layer.

Subsidence is the settlement of organic soils or of saturated mineral soils of very low density. Subsidence generally results from either desiccation and shrinkage, or oxidation of organic material, or both, following drainage. Subsidence takes place gradually, usually over a period of several years. The table shows the expected initial subsidence, which usually is a result of drainage, and total subsidence, which results from a combination of factors.

Potential for frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, saturated hydraulic conductivity (Ksat), content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured, clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that corrodes or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The steel or concrete in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than the steel

or concrete in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion also is expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Soil Features– San Miguel Area, Colorado, Parts of Dolores, Montrose, and San Miguel Counties									
Map symbol and soil name	Restrictive Layer				Subsidence		Potential for frost action	Risk of corrosion	
	Kind	Depth to top	Thickness	Hardness	Initial	Total		Uncoated steel	Concrete
		In	*In*		*In*	*In*			
23—Bodot, dry-Ustic Torriorthents complex, 5 to 50 percent slopes									
Bodot, dry	Paralithic bedrock	20-40	—	Weakly cemented	0	—	Low	High	Moderate
Ustic torriorthents	Lithic bedrock	10-80	—	Indurated	0	—	Low	Moderate	Low

Vegetative Productivity

This folder contains a collection of tabular reports that present vegetative productivity data. The reports (tables) include all selected map units and components for each map unit. Vegetative productivity includes estimates of potential vegetative production for a variety of land uses, including cropland, forestland, hayland, pastureland, horticulture and rangeland. In the underlying database, some states maintain crop yield data by individual map unit component. Other states maintain the data at the map unit level. Attributes are included for both, although only one or the other is likely to contain data for any given geographic area. For other land uses, productivity data is shown only at the map unit component level. Examples include potential crop yields under irrigated and nonirrigated conditions, forest productivity, forest site index, and total rangeland production under of normal, favorable and unfavorable conditions.

Rangeland Productivity and Plant Composition

In areas that have similar climate and topography, differences in the kind and amount of rangeland or forest understory vegetation are closely related to the kind of soil. Effective management is based on the relationship between the soils and vegetation and water.

This table shows, for each soil that supports vegetation suitable for grazing, the ecological site; the total annual production of vegetation in favorable, normal, and unfavorable years; the characteristic vegetation; and the average percentage of each species. An explanation of the column headings in the table follows.

An *ecological site* is the product of all the environmental factors responsible for its development. It has characteristic soils that have developed over time throughout the soil development process; a characteristic hydrology, particularly infiltration and runoff that has developed over time; and a characteristic plant community (kind and amount of vegetation). The hydrology of the site is influenced by development of the soil and plant community. The vegetation, soils, and hydrology are all interrelated. Each is influenced by the others and influences the development of the others. The plant community on an ecological site is typified by an association of species that differs from that of other ecological sites in the kind and/or proportion of species or in total production. Descriptions of ecological sites are provided in the Field Office Technical Guide, which is available in local offices of the Natural Resources Conservation Service (NRCS).

Total dry-weight production is the amount of vegetation that can be expected to grow annually in a well managed area that is supporting the potential natural plant community. It includes all vegetation, whether or not it is palatable to grazing animals. It includes the current year's growth of leaves, twigs, and fruits of woody plants. It does not include the increase in stem diameter of trees and shrubs. It is expressed in pounds per acre of air-dry vegetation for favorable, normal, and unfavorable years. In a favorable year, the amount and distribution of precipitation and the temperatures make growing conditions substantially better than average. In a normal year, growing conditions are about average. In an unfavorable year, growing conditions are well below average, generally because of low available soil moisture. Yields are adjusted to a common percent of air-dry moisture content.

Characteristic vegetation (the grasses, forbs, and shrubs that make up most of the potential natural plant community on each soil) is listed by common name. Under *rangeland composition*, the expected percentage of the total annual production is given for each species making up the characteristic vegetation. The amount that can be used as forage depends on the kinds of grazing animals and on the grazing season.

Range management requires knowledge of the kinds of soil and of the potential natural plant community. It also requires an evaluation of the present range similarity index and rangeland trend. Range similarity index is determined by comparing the present plant community with the potential natural plant community on a particular rangeland ecological site. The more closely the existing community resembles the potential community, the higher the range similarity index. Rangeland trend is defined as the direction of change in an existing plant community relative to the potential natural plant community. Further information about the range similarity index and rangeland trend is available in the "National Range and Pasture Handbook," which is available in local offices of NRCS or on the Internet.

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of vegetation, control of undesirable brush species, conservation of water, and control of erosion. Sometimes, however, an area with a range similarity index somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

Reference:
United States Department of Agriculture, Natural Resources Conservation Service, National range and pasture handbook.

Rangeland Productivity and Plant Composition– San Miguel Area, Colorado, Parts of Dolores, Montrose, and San Miguel Counties						
Map unit symbol and soil name	Ecological site	Total dry-weight production			Characteristic vegetation	Rangeland composition
		Favorable year	Normal year	Unfavorable year		
		Lb/ac	*Lb/ac*	*Lb/ac*		*Pct*
23—Bodot, dry-Ustic Torriorthents complex, 5 to 50 percent slopes						
Bodot, dry	Basin Shale	600	400	300	Galleta	15
					Black sagebrush	15
					Western wheatgrass	15
					Winterfat	10
					Wyoming big sagebrush	5
					Fourwing saltbush	5
					Shadscale saltbush	5
					Bottlebrush squirreltail	5
Ustic torriorthents	—	—	—	—	Wyoming big sagebrush	—
					Blue grama	—
					Indian ricegrass	—
					Bottlebrush squirreltail	—
					Galleta	—
					Saline wildrye	—

Water Management

This folder contains a collection of tabular reports that present soil interpretations related to water management. The reports (tables) include all selected map units and components for each map unit, limiting features and interpretive ratings. Water management interpretations are tools for evaluating the potential of the soil in the application of various water management practices. Example interpretations include pond reservoir area, embankments, dikes, levees, and excavated ponds.

Ponds and Embankments

This table gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect these uses. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the table indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the saturated hydraulic conductivity (Ksat) of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. Embankments that have zoned construction (core and shell) are not considered. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or

salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, Ksat of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Information in this table is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil between the surface and a depth of 5 to 7 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this table. Local ordinances and regulations should be considered in planning, in site selection, and in design.

Report—Ponds and Embankments

[Onsite investigation may be needed to validate the interpretations in this table and to confirm the identity of the soil on a given site. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the potential limitation. The table shows only the top five limitations for any given soil. The soil may have additional limitations]

Ponds and Embankments– San Miguel Area, Colorado, Parts of Dolores, Montrose, and San Miguel Counties							
Map symbol and soil name	Pct. of map unit	Pond reservoir areas		Embankments, dikes, and levees		Aquifer-fed excavated ponds	
		Rating class and limiting features	Value	Rating class and limiting features	Value	Rating class and limiting features	Value
23—Bodot, dry-Ustic Torriorthents complex, 5 to 50 percent slopes							
Bodot, dry	45	Very limited		Somewhat limited		Very limited	
		Slope	1.00	Hard to pack	0.21	Depth to water	1.00
		Seepage	0.43	Thin layer	0.86		
		Depth to bedrock	0.11				
Ustic torriorthents	40	Very limited		Somewhat limited		Very limited	
		Slope	1.00	Thin layer	0.83	Depth to water	1.00
		Depth to bedrock	0.83				
		Seepage	0.04				

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Emergency Response Plan

These procedures have been developed for use by Rimrock Exploration & Development (Rimrock) personnel during a response to an accident, fire, hazardous materials, or natural disaster incident at Rimrock mining sites. Note that all Rimrock personnel available during an emergency situation are required to respond. Emergency situations that cannot be resolved by the First Responder will trigger the activation of the site *Escape and Evacuation Plan*.

This document includes the following –

First Responder ..... Page 2

Escape and Evacuation Plan ..... Page 5

- **Surface and Underground Procedures – Attachment A**
- **Immediately Reportable Accidents and Injuries – Attachment B**
- **Emergency Notification Procedure – Attachment C**
- **Emergency Response Equipment – Attachment D**
- **Escape and Evacuation Plan Map – Attachment E**
  - **Ventilation Fan & Fan Controls**
  - **Stench Gas System**
  - **Fixed Portable Fire Extinguishers**

The first person to arrive at the location of an emergency situation becomes the First Responder to the incident and assumes responsibility for the subsequent emergency response until they are relieved by a more qualified person. The First Responder can be any Rimrock employee or a contractor's employee (e.g. truck driver).

Any emergency situation will be successfully resolved by a careful and measured response consisting of Assessment, Action, and Evaluation.

STEP ONE: **ASSESSMENT**

STEP TWO: **ACTION**

STEP THREE: **EVALUATION**

RESPONSE PROCEDURES

All Rimrock personnel are trained in basic fire fighting procedures and are required to make an initial response to control and extinguish small fires. An individual responder who cannot effectively control and extinguish a fire in the initial response will withdraw to a safe location and initiate the site ***Escape and Evacuation Plan.*** Personnel will assemble at the surface storage container and an assessment will be made to determine if the personnel available on site can effectively respond to the emergency situation. External emergency response agencies will be notified to assist with a response that cannot be effectively dealt with by the available mine site resources.

STEP 1.0 ASSESSMENT

The first step for a First Responder in an emergency situation is an effective and prompt **ASSESSMENT** of the situation. The First Responder shall immediately perform a situation assessment prior to initiating direct action during an emergency situation. The situation assessment should include the following information, at a minimum.

a) The location of the incident.
   a. General Location
   b. Access and Exit Routes
   c. Physical Layout and Restrictions
   d. Ground Conditions – Surface or Underground

b) The nature of the incident.
   a. Fire – Size and Source?
      i. Electrical
      ii. Fuel
      iii. Other Combustibles
      iv. Combination?
   b. Accident
      i. Personnel – Injury?
      ii. Equipment
         1. Fire Hazard?

c) Any ongoing physical hazards.
   a. Energized Electrical Circuits
   b. Leaking Fuel
   c. Other Chemical Agents
   d. Confined Space
   e. Ground Conditions

d) The nature and extent of any injury to personnel, when this can be determined.

e) The type and extent of any hazardous material spilled, if known.

f) Resources available for response operations.
   a. Fire Extinguishers – Type and Location
   b. Mobile Equipment
   c. Hand Tools – Shovels
   d. Personnel

STEP 2.0 **ACTION**

The limiting factors of terrain and distance dictate that many emergency situations that occur at Rimrock mine sites will have to be successfully resolved or controlled by on-site personnel before external agencies or organizations will be able to mobilize and arrive on-site.

On-site personnel involved in responding to an emergency scene must carefully ASSESS the situation prior to committing themselves and others to action. The severity of any injury, the quantity and concentration of any hazardous material released, the presence or absence of fire and/or energized electrical circuits, and the location of the incident are some of the primary factors used in determining an operations strategy both before and during an incident response. Responders should always perform a thorough initial and ongoing incident assessment that accounts for these factors, and adjust their actions accordingly. A thorough incident assessment should include the following aspects:

1) The presence of physical and electrical hazards, or hazardous materials.
2) The physical layout of the incident area.
3) The presence and extent of any injuries.
4) The type and quantity of materials spilled, if any.
5) Any actions already taken.
6) The number and skills of available personnel.
7) The type and quantity of available equipment and supplies.
8) The type and availability of both internal and external support.
9) Alternate courses of action.

Response actions will usually occur in two distinct, but often overlapping, stages once the incident assessment is complete. The first stage consists of those direct and immediate actions taken by the First Responder. The second stage of action consists of coordinated site-wide actions taken to successfully resolve a situation by multiple response personnel and / or external response agencies. Actions taken by the First Responder may, or may not, successfully resolve the emergency at the Stage 1 level of action. If the First Responder can successfully resolve the situation then the second stage of action will terminate with the mobilization of site personnel under the site Escape and Evacuation Plan. If the First Responder cannot successfully resolve the situation, or if the situation is beyond the First Responder's capabilities to resolve, then the second stage of response actions will continue through ongoing field response actions until a successful resolution of the emergency situation has occurred.

Responders should always attempt to de-energize electrical equipment and eliminate ongoing leak or spill sources (re. closing valves, etc.), both prior to and during operations, if the responder(s) will not be exposed to an unwarranted level of risk while doing so.

The rescue of injured personnel; the prompt extinguishment or containment of fires to a limited area; and the containment of spilled materials is a primary goal of any field response action during these types of emergency situations.

The use of proper personal protection equipment (PPE) is mandatory during response operations. The type of PPE used will depend on the type of emergency situation encountered. Note that Mine Self-Rescuers are not permissible to use as respiratory protection devices for fighting fires.

First Responder

The first person to arrive at the location of an emergency situation becomes the First Responder to the incident and assumes responsibility for the subsequent emergency response until they are relieved by a more qualified person. The First Responder can be any Rimrock employee or contractor's employee (e.g. truck driver).

Assessment

The First Responder shall immediately perform a careful situation **assessment** prior to taking any other action during an emergency response.

Field Action

After the assessment the First Responder will proceed to the Field Action Phase of response. The type of action taken by the First Responder during an emergency situation will depend on an ongoing evaluation of the incident and the First Responder's capability to respond.

First Responders should always make an initial response to incidents that are within the capabilities of a single person to correct, or control, until help arrives. Generally, a single person can successfully extinguish or control small fires, small hazardous material spills, and minor accidents that do not represent an unwarranted health hazard to a single responder. The First Responder must always be prepared to retreat and provide emergency notification to other site personnel if the initial situation assessment, or the responder's ongoing evaluation, indicates that an unwarranted hazard exists or may develop.

First Responder Guidelines

- Assess
- Take Direct Action or Retreat & Activate Emergency System, if situation warrants
- When Taking Action –
  - Reduce or Eliminate Hazards to the Responder
    - Move to the Fresh Air Base
    - Move Uphill of Blockages Underground
    - De-energize Electrical Circuits
    - Establish Clear Access & Exit Paths
  - Rescue & Treat Injured Personnel
  - Extinguish or Control Small Fires
    - Fire Triangle – Remove Fuel, and / or Oxygen, and / or Heat
    - Remember > Aim at the base of the fire and sweep side to side in a measured, but rapid motion, overlapping the edges of the fire zone.
    - Never use a Self-Rescuer to fight a fire.
  - Control Spills of Hazardous Materials, if possible
- Re-Assess & Evaluate
  - Alert other site personnel, even if the situation appears to be successfully resolved.

ESCAPE AND EVACUATION PLAN

Site-wide emergency response actions are coordinated operations involving multiple personnel and / or external responding agencies. Site-wide emergency response actions are triggered by the activation of the site *Escape and Evacuation Plan* and proceed through the three distinct activity phases of Alert, Mobilization, and Field Actions.

Alert

Notification of other site personnel and activation of the ***Escape and Evacuation Plan*** constitutes the Alert phase of a site-wide response action. All Rimrock and non-Rimrock personnel are to immediately proceed to a designated assembly point when the *Escape and Evacuation Plan* is activated.

Mobilization

All responses to an emergency situation at Rimrock mining sites will continue through Mobilization. Mobilization consists of the assembly and organization of site personnel for coordinated response operations and will terminate after all personnel are assembled if the emergency situation is successfully resolved at the First Responder level. The site will demobilize and the Evaluation Stage of the emergency response will be executed if the situation is resolved at the First Responder level.

~ Mobilization: Assembly

All personnel who are able are required to report to a designated assembly point when an emergency notification is received.

> The primary assembly point for all Rimrock personnel during an emergency situation is the Surface Storage Container/Cargo Van.

> The site Entrance Gate is the primary assembly area for contractor personnel (unless the contractor is the First Responder) and site visitors, and the alternate assembly point for Rimrock personnel if the primary assembly point is inaccessible.

Site-Wide Field Action

A Site-Wide Field Action is a coordinated field response to an emergency situation by multiple personnel. This level of response occurs when an emergency situation cannot be successfully resolved at the First Responder level. These field actions consist of operations undertaken in the field by multiple personnel and perhaps with outside agencies that are designed and implemented in order to control or abate an emergency situation. A coordinated field response operation will continue until the situation has been successfully resolved.

Field Action: Operations

The specific course of action taken during a site-wide Field Action will be determined by the ongoing incident assessment and coordinated by the Emergency Coordinator.

Field Action: Emergency Coordinator

The Mine Supervisor, or their designee, will usually be the Emergency Coordinator for the mine site until relieved by an authorized emergency response coordinator from Rimrock or an external agency representative with recognized authority. The Emergency Coordinator can be the initial First Responder or a person of higher authority who relieves the First Responder as coordinator, if the Mine Supervisor is unavailable. The Emergency Coordinator will activate the site Escape and Evacuation Plan and is responsible for coordinating the response action.

The Emergency Coordinator will:

- Activate the *Escape and Evacuation Plan Surface and Underground Procedures* (Attachment A). Introduce Stench Gas into the underground ventilation system to notify underground personnel that an emergency situation exists requiring an immediate withdrawal from the underground workings.
- Consult the Brass Board and Visitor Log and complete, or delegate the completion of, an accounting of all Rimrock and contractor personnel and site visitors at the site.
- Ensure that all personnel who can be alerted are notified of the emergency.
- Provide an initial situation report to all response personnel at the primary assembly point.
- Review the incident assessment, determine a preliminary course of action, and delegate specific duties to response personnel.
- Establish an incident command post at a safe location near the incident location with secure communication links to off-site entities and ensure that communications are functional. Activate the Emergency Notification Procedure (Attachment C).
- Organize response personnel for deployment based upon the initial situation report and the projected course of action. This will include the delineation of specific responsibilities or duties; the provision of proper PPE (minimum of hard hats, safety shoes, and gloves; the collection of specialized equipment; and the establishment of a support base, including communications.
- Establish a preliminary field response plan based upon the initial situation report and the projected course of action.
- Act first and foremost to prevent unwarranted occupational and environmental exposures from occurring during emergency incidents.
- Monitor response activities and suspend any response activity that creates, or may create, an unwarranted exposure risk to personnel.
- Coordinate field response actions until the emergency situation is successfully resolved.
- Perform an ongoing incident evaluation and determine an appropriate course of action for the response activity, in coordination with other relevant personnel.
- Coordinate with external emergency responders when they are available.
- Ensure that communications with the incident command post and off-site entities are maintained. Activate the Emergency Notification Procedure (Attachment C), as necessary.
- Ensure that the incident response action is provided with resources that are adequate to sustain the response activity. This includes the provision of proper PPE, sufficient quality and quantities of equipment, and adequate numbers of personnel for both operations and back-up.

Escape and Evacuation Plan Summary

- Alert
  - First Responder Notify Mine Supervisor (or other available personnel if Mine Supervisor is not immediately available) that an emergency situation exists.
- Assemble & Mobilize
  - Mine Supervisor / Emergency Coordinator activate site ***Escape and Evacuation Plan Surface & Underground Procedures (Attachment A).***
    - **Introduce Stench Gas** into the underground mine ventilation system.
  - Rimrock Personnel –
    - **Underground personnel evacuate** underground workings and Brass Out.
    - All Rimrock personnel assemble at the Surface Storage Container / Cargo Van
  - Contractor(s) & Visitors – Assemble at Entrance Gate
  - Account for all people on-site
  - Establish Communications – Internal and with External Agencies, as needed.
    - Activate ***Emergency Notification Procedure (Attachment C)***
  - Begin to Gather Resources – Personnel & Equipment
- Assess
  - Situation Assessment
  - Establish Plan of Action
  - Complete Resource Gathering
  - Assign Duties
- Action (actions can be performed simultaneously – Rescue is always a high priority)
  - Reduce or Eliminate Hazards to Responders – Safety First!
    - Move to the Fresh Air Base
    - Move Uphill of Blockages Underground
    - De-energize Electrical Circuits
    - Establish Clear Access & Exit Paths
  - Rescue & Treat Injured Personnel
  - Accidents / Injuries (including entrapment, unplanned fires, explosions, ground control failures) –
    - Consult the guidelines in ***Attachment B - Immediately Reportable Accidents and Injuries*** to determine if an accident or injury is immediately reportable to MSHA.
    - **Injuries requiring EMS care - Nucla/Naturita Fire Department 911 or 970-864-7333**
  - Extinguish or Control Fires
    - Fire Triangle – Remove Fuel, and / or Oxygen, and / or Heat
    - Aim extinguishing agents at the base of the fire and sweep side to side in a measured, but rapid motion, overlapping the edges of the fire zone.
    - Coordinate multiple extinguishers. Maintain reserve extinguishers.
    - Fuel-in-depth – Use sideways sweeping extinguisher motions to push the flames away from the firefighters and towards one side and off of one edge of ponded fuel.
    - Construct firebreaks, as needed.
    - Perform overhaul until all threat of re-ignition is eliminated.
    - Never use a Self-Rescuer to fight a fire.
  - Control Spills of Hazardous Materials.
    - Dam, dike and berm to contain spilled liquids.
    - Ponded-in-depth materials can be pumped to secondary containers, if practicable.
    - Absorb with non-reactive materials (e.g. soils) and contain with secondary berm.

- Re-Assess & Evaluate
  - o Maintain alert status, even if the situation appears to be successfully resolved.
  - o Revise Plan of Action, as needed, to resolve emergency situation.
  - o Post-emergency action, evaluate initial emergency situation and responses taken.

STEP 3.0 **EVALUATION**

A successful resolution to the operations phase of an emergency situation at Rimrock mining sites will be followed by remediation actions designed to both mitigate the adverse effects of the emergency and reduce the potential for a recurrence of a similar situation. Remediation actions consist of regulatory agency notification, clean-up activities at fire and spill locations, and formal and informal reviews of the emergency and the emergency response plan implementation.

Governmental Agency Notification

The following notifications of government agencies are required when certain criteria are met during a fire or spill incident.

For Fires –

> See *Attachment B – Immediately Reportable Accidents and Injuries* for MSHA reporting criteria.

> Potentially Uncontrolled Fires on the Surface – Nucla/Naturita Fire Department 970-864-7333
USBLM

For Spills – The only materials stored in sufficient quantities to represent a pollution threat to the environment are petroleum products (specifically Diesel Fuel) and Natural Uranium Ore. Spill reports must be completed within 24 hours of a reportable quantity spill.

> Petroleum Spills Greater than 25 Gallons

> Uranium Ore Spills Greater than 65 Tons – USEPA 24-Hour Spill Number 1-800-424-8802
CDPHE Emergency Management Unit 1-877-518-5608

Clean-up: General

An evaluation for cleanup requirements at any fire or spill site will be performed by Rimrock management personnel immediately upon the successful conclusion of field response operations. This evaluation will include the following considerations, at a minimum.

1) Type of material spilled.
2) Type of material(s) or structures affected by the incident.
3) Affected area (physical extent of contamination).
4) Physical configuration of the spill or fire area.
5) Personnel requirements and availability.
6) Equipment requirements and availability.
7) Proper Disposal requirements.

Note: Radioactive materials will be promptly retrieved from off-site areas as soon as is practical.

Rimrock management will be responsible for coordinating cleanup activities in accordance with the post-field operations evaluation.

Review & Reports

The final stage in any emergency response activity is a complete review of the circumstances leading to the emergency, all response actions taken during the emergency, and post-response remediation activities.

Rimrock Exploration & Development management will coordinate the requisite review and issue an internal report summarizing the findings, including any necessary corrective actions to company procedures.

Rimrock will oversee the preparation of any requisite reports to the Federal Mine Safety & Health Administration, USEPA, USBLM and any other relevant local, State and Federal agencies.

These reports will include any necessary five or thirty day post-incident reviews for distribution and review to corporate management and all relevant government agencies.

EMERGENCY RESPONSE TRAINING

Training

Response personnel have the following training:

1) Forty (40) hour general safety training session for the metal and non-metal surface and underground mining industry upon initial hiring with eight (8) hour annual refresher training. Topics include:
   - First Aid
   - Hazard Recognition
   - Fire-fighting
   - Hazardous Materials (HazCom)
   - Safe work practices

2) HMTA-DOT Hazardous Materials Handling training, with site-specific training for hazardous materials.

3) Four hour Basic CPR/First Aid Certification Training is provided by professional EMT's for relevant personnel.

4) Weekly (tailgate) safety meetings with an open discussion of site conditions, hazards and safety practices.

ATTACHMENT A

SURFACE PROCEDURES:

When the Mine Supervisor or his designee on the surface is notified of an emergency and deems it advisable to evacuate or notify the personnel underground they will proceed as follows;

1. Induce stench gas at the main fan to alert underground workers of an immediate danger. Operational procedures are as follows:

Step 1= Locate stench bottle located next to main fan.
Step 2=Remove Stench Bottle from stand and aim it towards main fan intake
Step 3= Open valve on bottle to give a 5 second burst of gas into the main fan.
Step4= Record time, go to office and pick up cell phone then to portal to verify the smell of stench and monitor phone.
Step5=Record time, have personnel brass out as they exit mine and proceed to assembly area.

2. Monitor the communication system and give instructions to the underground workers for escape plans or to seal themselves into a refuge chamber.
3. Assign employees to account for underground personnel as they exit the mine, miners will brass out as they exit

UNDERGROUND PROCEEDURES:

1. When the odor of the stench is detected employees will immediately proceed to the nearest communication system and call the surface for further instructions.
2. If you are unable to reach a fresh air source or if the communication system fails to work, then proceed to the surface via the nearest exit.
3. If in the event that item number 1 or 2 above cannot be accomplished, then employees should proceed to the nearest refuge chamber and seal themselves in. Time, date and number of people should be written on the outside of the refuge chamber.
4. Once a refuge chamber has been sealed you are to remain there until it is opened from the outside.
5. At first indication of smoke or fire the self rescuer will be deployed until fresh air has been reached, or you are sealed inside the refuge chamber and verified the atmosphere within is not contaminated. Contaminants are to be purged as outlined in Attachment F.

Prince Albert Mine Site
Ventilation and Escape
Facilities and Personnel

Emergency Communications

Communications is provided by cell phones. One cell phone# 970-260-0966 will be kept in the company vehicle for primary and emergency communication.

A cell phone booster is located at the bottom of the incline and allows for use of a cell phone at this location. A cell phone # 970-260-4773 will be kept with the booster at this location for emergency communications. These phones will be tested as part of the pre shift inspection.

Emergency Transportation

Emergency transportation will be provided by the Nucla Naturita Fire Department located in Nucla and Naturita CO. Response time is estimated at thirty minutes. They have a four wheel drive ambulance, and are provided with maps and directions to the site.

Emergency power

Emergency power will be provided by a generator and is located at 26164 Z 26 road Nucla, Colorado 81424. A generator may also be rented from a rental company in Grand Junction CO.

Emergency ventilation

Emergency ventilation fans and controls equal to the existing fan are available and are located at 26164 Z 26 road Nucla CO 81424. A generator will be required to run these fans as the current fan is a diesel belt driven fan.

Rescue personnel and equipment

San Juan Mine Rescue will provide personnel and equipment. Their base is located in Ridgeway Colorado. Response time is estimated at 1.5 hours.

ORGANIZAION AND RESPONSIBILITIES:
Quick Guide

1. The Mine Supervisor or his designee on the surface at the mine will be responsible for inducing stench and accounting for all employees on duty.

2. As soon as practical notification of management and outside emergency response agencies will be accomplished as prescribed in Attachment C.

3. The Mine Supervisor or his designee will establish the incident command post in the mine office, verify that all personnel are accounted for and direct activities of the emergency operations at the mine site.

4. The Mine Supervisor or his designee will notify the appropriate State and Federal agencies as required. Mine rescue notification will be accomplished in accordance with the emergency notification procedure chart (Attachment C). The complete list of mine rescue members is posted in the mine office; these will be called after the initial notifications are made.

5. The Mine Supervisor will post guards at the portal and other locations that require isolation.

6. The Mine supervisor will have additional equipment made readily available from inventory or surrounding mines and other companies.

Prince Albert Mine Site
Escape and Evacuation Plan
Quick Guide
January 24, 2010

This Prince Albert Mine Escape and Evacuation Plan were developed following the format presented in 30CFR part 57.11053.

OBJECTIVE:
To evacuate all employees in a safe and orderly manner in the event of an emergency situation such as a mine fire, unplanned explosion, earth quake, etc.

PROCEDURES:
In the event of an emergency where the safety of the employees is endangered the following procedures will be followed.

1. Stench gas will be induced into the ventilation system to notify underground employees of an emergency situation requiring immediate response or withdrawal from the underground workings. See attachment "A".

2. Employees shall immediately brass out as they exit the mine and then check in at the cargo van/office for further instructions.

3. Emergency medical services and transportation of the injured will be arranged by the Mine Supervisor or his designee. Telephones are located at the bottom of the incline and in the Company vehicle.

4. Notifications will be completed by following the following procedures on the Emergency Notification Procedures Chart (Attachment C).

5. Mobilizing emergency medical services is primary, in the event that the emergency falls into one of the twelve immediately reportable accidents or injuries as defined by MSHA (see Attachment B), the Mine Supervisor or his designee will call the MSHA one call number immediately.

6. Statements to the public or news media will be handled through Rimrock Exploration and Development, Inc., Management.

Attachment B

Immediately Reportable Accidents and Injuries

1-800-746-1553

Immediately Reportable Accidents and Injuries are:

1. A death of an individual at a mine;
2. An injury to an individual at a mine which has a reasonable potential to cause death;
3. An entrapment of an individual for more than thirty minutes or which has a reasonable potential to cause death;
4. An unplanned inundation of a mine by a liquid or gas;
5. An unplanned ignition or explosion of gas or dust;
6. In underground mines, an unplanned fire not extinguished within 10 minutes of discovery; in surface mines and surface areas of underground mines, an unplanned fire not extinguished within 30 minutes of discovery;
7. An unplanned ignition or explosion of a blasting agent or an explosive;
8. An unplanned roof fall at or above the anchorage zone in active workings where roof bolts are in use; or, an unplanned roof or rib fall in active workings that impairs ventilation or impedes passage;
9. A coal or rock outburst that causes withdrawal of miners or which disrupts regular mining activity for more than one hour;
10. An unstable condition at an impoundment, refuse pile, or culm bank which requires emergency action in order to prevent failure, or which causes individuals to evacuate an area; or, failure of an impoundment, refuse pile, or culm bank;
11. Damage to hoisting equipment in a shaft or slope which endangers an individual or which interferes with use of the equipment for more than thirty minutes; and
12. An event at a mine which causes death or bodily injury to an individual not at the mine at the time the event occurs.

Mine operators must call immediately, but no later than 15 minutes from the time they know or should know that an accident has occurred.

Attachment c

Prince Albert Mine ID# 0504913
Rimrock Exploration and Development, Inc.
Emergency Notification Procedure

LATITUDE 38 DEG 22.301 MIN, north
LONGITUDE 108 DEG 47.428 MIN west

1. Person discovering cause for emergency will immediately notify all endangered personnel to evacuate and relay emergency information to the person in charge or his designee.
2. Person in Charge or his designee will notify.

Montrose county Dispatch 970-864-7333

And one of the following Rimrock Exploration and Development, Inc. management

Alan Chiles 970-417-1239
Clifford Chiles 970-428-2242
David Chiles 970-864-7263, C) 970-270-4265
Wesley Chiles 970-417-5068

3. All above persons will notify.

San Juan Mine Rescue 970-385-4528

MSHA One Call Number 800-746-1553

San Juan Mine Rescue Coordinator
Jess Fullbright H) 970-864-2116, C) 970-428-7001, W) 970-864-7775

4. Rimrock Exploration and Development, Inc., management will notify San Juan Mine Rescue, mine rescue team members:

Tom Bird	H) 970-385-4528x14, C) 970533-7260, W) 970-769-1160
Ron Williams	H) 970-209-3624, C) 970-209-3624, W) 970-209-3624
Matt Maxwell	H) 970-626-2884, C) 970-626-3569, W) 970-318-1244
Dan Redetzke	H) 970-385-4528x18, C) 970-769-6159, W) 970-769-6159
Joe Smart	H) 970-728-3811, C) 970-252-1616, W) 970-901-8892
Doug Wyman	H) 970-533-9052, C) 970-533-7904, W) 970-799-1375
Wade Wymore	H) 970-385-4528x10, C) 970749-0341, W) 970-749-0341

All members of mine rescue team from team roster

ATTACHMENT D

ESCAPE AND EVACUATION PLAN

EMERGENCY RESPONSE EQUIPMENT

This list contains the equipment on site that may be used in responding to an emergency situation at Rimrock mine sites -

	Location:
First Aid:	
• Portable First Aid Kits	Surface Storage Container / Cargo Van
• Eye Wash (Bottled Water)	Surface Storage Container / Cargo Van
PPE Equipment:	Location:
• Respirators (Half & Full-face)	Rimrock Underground Personnel, Storage Container
• Rubber Gloves	Rimrock Underground Personnel, Storage Container
• Steel-Toed Boots	Rimrock Underground Personnel, Storage Container
Fire-Fighting Equipment:	Location:
• Fire Extinguishers	Mine Portal (Entrance)
- Dry Chemical, Manual (5 & 10 lb.)	Powder Magazines
	Surface Storage Container / Cargo Van
	Mine Ventilation Fan
	Surface Air Compressor
	Each Piece of Mobile Equipment
Earthmoving Equipment:	Location:
• Wheel Loader (3+ yd.)	Surface during Ore Hauling Off-Site
• Skid Steer Loader	Underground/Surface
• 3 to 5 Ton Haul Trucks	Underground/Surface
• Hand Tools (Picks, Shovels, etc)	Surface Storage Container, Underground
Other Equipment:	Location:
• Pickup and Cargo Trucks	Various Locations on surface

External Assistance for Response and Clean-up

Tomcat Mining	Naturita, Colorado	970-865-2886	or 970-865-2887

Attachment B

Prince Albert Mine

CDRMS

Reclamation Cost Estimates

STATE OF COLORADO

DIVISION OF RECLAMATION, MINING AND SAFETY
Department of Natural Resources

1313 Sherman St., Room 215
Denver, Colorado 80203
Phone: (303) 866-3567
FAX: (303) 832-8106

COLORADO DIVISION OF RECLAMATION MINING & SAFETY

John W. Hickenlooper
Governor

Mike King
Executive Director

Loretta Piñeda
Director

July 5, 2012

Tim Pierce Consultant
Alan and Wesley Chiles
Rimrock Exploration and Development, Inc.
P.O. Box 430
Nucla, Colorado 81424

RE: Prince Albert Mine, 110d Designated Mining Operation Permit Application, No. M-2011-040, Reclamation Liability Estimate.

Dear Mr. Pierce and Chiles,

The Division of Reclamation, Mining, and Safety (Division) is completing the review process of the above referenced 110d application. Based on the application's mine and reclamation plans, corrections, and clarifications staff has estimated the initial reclamation liability to reclaim the site. (Copy Enclosed). The initial reclamation liability is estimated to be $46,130.00.

A copy of the estimate has been forwarded to the Bureau of Land Management (BLM). Per the Memo of Understanding the BLM must concur on the amount for the bond. However, BLM has elected not initiated its review process concurrently to the Division's. Therefore, the Division will request BLM concur in writing on the current estimate with the understanding that once their Plan of Operation review is completed adjustments may be made at that time if necessary.

Currently the decision date is set for July 13, 2012. Please note that the 365 day limit for this application is July 25, 2012.

If you need additional information please contact me at the Division of Reclamation, Mining and Safety, Grand Junction Field Office, 101 S. 3rd St., Suite 301, Grand Junction, Colorado 81501, by telephone at 970.241.1117, or by e-mail at russ.means@state.co.us.

Sincerely,

G. Russell Means

G. Russell Means
Senior Environmental Protection Specialist
Grand Junction / Durango Field Office Supervisor

EC: Rob Ernst, BLM Uncompahgre Field Office, Montrose, CO

Enclosed: Initial Reclamation Liability Estimate

COST SUMMARY WORK

Permit Action: Initial Reclamation Liability Estimate - 2012

Site: **Prince Albert Mine**

Permit/Job#: M2011040

PROJECT IDENTIFICATION

Task #: 000
Date: 7/5/2012
User: GRM

State: Colorado
County: Montrose

Abbreviation: None
Filename: M040-000

Agency or organization name: DRMS

TASK LIST (DIRECT COSTS)

Task	Description	Form Used	Fleet Size	Task Hours	Cost
001	ore pad wash down	MISCTRUK	1	16.00	$1,104.00
002	remove sediments from ore pad to portal, misc. earthwork	LOADER	1	4.65	$400.00
003	cap ore stockpile area	DOZER	1	11.74	$1,493.07
004	demo fans, remove mine support structures	DEMOLISH	1	16.00	$2,951.88
005	seal portal and vent shaft	MINESEAL	1	20.00	$4,037.00
006	seal monitor well and utility drop	BOREHOLE	1	8.00	$415.39
007	grade out stormwater structures	DOZER	1	26.64	$3,497.83
008	grade out 3:1 slopes on primary waste pile	DOZER	1	14.12	$1,854.44
009	rip access roads, utility, and waste pile compacted areas	RIPPER	1	4.33	$575.00
010	spread topsoil over site	LOADER	1	27.45	$2,360.00
011	grade out 3:1 slopes on secondary waste pile	DOZER	1	6.81	$894.14
012	spread topsoil secondary waste pile	DOZER	1	5.32	$698.29
013	Revegetation of 5 acres of disturbed lands	REVEGE	1	24.00	$9,718.35
014	mobilization ot site	MOBILIZE	1	3.80	$2,656.82
			SUBTOTALS:	**188.86**	**$ $32,656.21**

INDIRECT COSTS

OVERHEAD AND PROFIT:

Liability insurance:	2.02	Total =	$659.66
Performance bond:	1.05	Total =	$342.89
Job superintendent:	94.43	Total =	$5,599.70
Profit:	10.00	Total =	$3,265.62
		TOTAL O & P =	$9,867.87
		CONTRACT AMOUNT (direct + O & P) =	$42,524.08

LEGAL - ENGINEERING - PROJECT MANAGEMENT:

Financial warranty processing (legal/related costs):	500.00	Total =	500.00
Engineering work and/or contract/bid preparation:	0.00	Total =	$0.00
Reclamation management and/or administration:	5.00		$2,126.20
CONTINGENCY:	3.00	Total =	$979.69
		TOTAL INDIRECT COST =	$13,473.76
		TOTAL BOND AMOUNT (direct + indirect) =	**$46,130.00**

MISCELLANEOUS TRUCK WORK

Task description: **Ore pad wash down**

Permit Action: Initial Reclamation Liability Estimate - 2012

Site: **Prince Albert Mine**

Permit/Job#: M2011040

PROJECT IDENTIFICATION

Task #:	001	State:	Colorado	Abbreviation:	None
Date:	7/3/2012	County:	Montrose	Filename:	M040-001
User:	GRM				

Agency or organization name: DRMS

HOURLY EQUIPMENT COST

Make and Model:	Water Tanker, 3,500 Gal.	Horsepower:	250
Attachment 1:		Shift Basis:	1 per day
Attachment 2:		Weight:	6.25 (US Tons)
Labor Unit 1:	Specialty Truck Driver		
Labor Unit 2:			

Cost Breakdown:

		Utilization %
Ownership Cost/Hour:	$10.97	NA
Operating Cost/Hour:	$35.80	100
Operator Cost/Hour:	$22.23	NA
Total Unit Cost/Hour:	$68.99	
Total Fleet Cost/Hour:	$68.99	

JOB TIME AND COST

Fleet size:	1	Truck(s)	Total job time:	**16.00**	Hours
Unit cost:	$68.99	/Hour	Total job cost:	**$1,104.00**	

WHEEL LOADER – LOAD AND CARRY WORK

Task description: **Remove sediments from ore pad to portal, misc. earthwork**

Permit Action: Initial Reclamation Liability Estimate - 2012

Site: **Prince Albert Mine**

Permit/Job#: M2011040

PROJECT IDENTIFICATION

Task #: 002
Date: 7/3/2012
User: GRM

State: Colorado
County: Montrose

Abbreviation: None
Filename: M040-002

Agency or organization name: DRMS

HOURLY EQUIPMENT COST

Basic Machine: CAT 446D
Attachment 1: ROPS Cab

Horsepower: 101
Shift Basis: 1 per day
Data Source: (CRG)

Cost Breakdown:

		Utilization %
Ownership Cost/Hour:	$17.87	NA
Operating Cost/Hour:	$29.61	100
Operator Cost/Hour:	$38.49	NA
Total Unit Cost/Hour:	$85.97	
Total Fleet Cost/Hour:	$85.97	

MATERIAL QUANTITIES

Initial volume: 500 CCY
Loose volume: **500** LCY

Swell factor: 1.000

Source of estimated volume: Division of Reclamation, Mining & Safety
Source of estimated swell factor: Cat Handbook

HOURLY PRODUCTION

Loader Cycle Time: Unadjusted Basic Cycle Time (load, dump, maneuver): 0.475 minutes

Cycle Time Factors		Factor (min.)	Source
Material:	Mixed material 0.02	0.020	(Cat HB)
Stockpile:	No adjustment - factor not applicable 0.00	0.000	(Cat HB)
Truck Ownership:	No adjustment - factor not applicable 0.00	0.000	(Cat HB)
Operation:	Inconsistent operation 0.04	0.040	(Cat HB)
Dump Target:	Small target 0.04	0.040	(Cat HB)
	Net Cycle Time Adjustment:	0.100	minutes
	Adjusted Basic Cycle Time:	0.575	minutes

Rolling Resistance – Road Conditions

Haul: Rutted dirt, little maintenance, no water, 1" tire penetration 4.0
Return: Rutted dirt, little maintenance, no water, 1" tire penetration 4.0

Haul and Return Time

	Length (feet)	Grade Res. (%)	Rolling Res. (%)	Total Res. (%)	Travel Time (minutes)	Source
Haul Route:	150	2.00	4.00	6.00	0.1164	(Cat HB)

Return Route:	150	-2.00	4.00	2.00	0.0740	(Cat HB)

Total Travel Time: 0.1904 minutes
Total Cycle Time: **0.7654** minutes

Load Bucket Capacity

Rated Capacity: 1.50 LCY (heaped)
Bucket Fill Factor: 1.100 Other - rock/dirt mixtures (100-120%) 1.100
Adjusted Capacity: **1.65** LCY

Job Condition Correction Factors
Site Altitude: 5900 feet

		Source
Altitude Adj:	1.00	(CAT HB)
Job Efficiency:	0.83	(1 shift/day)
Net Correction:	0.83	multiplier

Unadjusted Hourly Unit Production: 129.35 LCY/Hour
Adjusted Hourly Unit Production: 107.36 LCY/Hour
Adjusted Hourly Fleet Production: **107.36** LCY/Hour

JOB TIME AND COST

Fleet size: 1 Loader(s) Total job time: **4.66** Hours

Unit cost: $0.801 /LCY Total job cost: **$400.00**

BULLDOZER WORK

Task description: **Cap ore stockpile area**

Permit Action: Initial Reclamation Liability Estimate - 2012

Site: **Prince Albert Mine**

Permit/Job#: M2011040

PROJECT IDENTIFICATION

Task #: 003
Date: 7/3/2012
User: GRM

State: Colorado
County: Montrose

Abbreviation: None
Filename: M040-003

Agency or organization name: DRMS

HOURLY EQUIPMENT COST

Basic Machine: Cat D6T
Horsepower: 185
Blade Type: Semi-Universal
Attachment: NA
Shift Basis: 1 per day
Data Source: (CRG)

Cost Breakdown:

		Utilization %
Ownership Cost/Hour:	$31.46	NA
Operating Cost/Hour:	$57.18	100
Ripper op. Cost/Hour:	$0.00	0
Operator Cost/Hour:	$38.49	NA

Total unit Cost/Hour: $127.14
Total Fleet Cost/Hour: **$127.14**

MATERIAL QUANTITIES

Initial Volume: 1,000
Swell factor: 1.000
Loose volume: **1,000** LCY

Source of estimated volume: Division of Reclamation, Mining & Safety
Source of estimated swell factor: Cat Handbook

HOURLY PRODUCTION

Average push distance: 150 feet
Unadjusted hourly production: 212.5 LCY/hr

Materials consistency description: Rock, well ripped or blasted 0.8

Average push gradient: -5 %
Average site altitude: 5,900 feet

Material weight: 2,550 lbs/LCY

Weight description: Sandstone

Job Condition Correction Factor		Source
Operator Skill:	0.750	(AVG.)

Material consistency:	0.800	(CAT HB)
Dozing method:	1.000	(GEN.)
Visibility:	1.000	(AVG.)
Job efficiency:	0.830	(1 SHIFT/DAY)
Spoil pile:	0.800	(FND-RF)
Push gradient:	1.115	(CAT HB)
Altitude:	1.000	(CAT HB)
Material Weight:	0.902	(CAT HB)
Blade type:	1.000	(PAT)

Net correction: 0.4007

Adjusted unit production: 85.15 LCY/hr

Adjusted fleet production: **85.15** LCY/hr

JOB TIME AND COST

Fleet size: 1 Dozer(s)

Unit cost: $1.493/LCY

Total job time: **11.74** Hours

Total job cost: **$1,493.07**

SAFEGUARDING UNDERGROUND OPENINGS

Task description: **Seal portal and vent shaft**

Permit Action: Initial Reclamation Liability Estimate - 2012

Site: **Prince Albert Mine**

Permit/Job#: M2011040

PROJECT IDENTIFICATION

Task #: 005
Date: 7/3/2012
User: GRM

State: Colorado
County: Montrose

Abbreviation: None
Filename: M040-005

Agency or organization name: DRMS

UNIT COSTS

Opening Description	Dimensions	Closure Method	Quantity	Unit	Unit Cost	Total Cost
main portal	10 X 10	Adit closure - backfilling (per opening)	1.00	EA	$1,852.00	$1,852.00
main vent shaft	48" dia	Shaft closure - polyurethane foam plug (per cu. yd.)	9.50	CY	$230.00	$2,185.00

Job Hours: **20.00**

Total Cost: **$4,037.00**

DEMOLITION WORK

Task description: **Demo fans, remove mine support structures**

Permit Action: Initial Reclamation Liability Estimate - 2012

Site: **Prince Albert Mine**

Permit/Job#: M2011040

PROJECT IDENTIFICATION

Task #: 004
Date: 7/3/2012
User: GRM

State: Colorado
County: Montrose

Abbreviation: None
Filename: M040-004

Agency or organization name: DRMS

UNIT COSTS

Location adjustment: 96.90 %

Structure or Item Description	Dimensions	Demolition Menu Selection	Quantity	Unit	Unit Cost	Total Cost
misc work	5 X 5	CAT 446D	16.00	1	$85.97	$1,375.52
misc lifting / loading	n/a	Grove GMK3055, 141', 54.4MT	8.00	EA	$200.07	$1,600.56
misc storage units, etc	n/a	Loading and 5 mile haul, salvage allowed - Steel frame structures	8.00	CY	$8.78	$70.24

Job Hours: **16.00**

Subtotal (unadjusted): **$3,046.32**

Total Cost (adjusted for location): **$2,951.88**

BOREHOLE SEALING WORK

Task description: **Seal monitor well and utility drop**

Permit Action: Initial Reclamation Liability Estimate - 2012

Site: **Prince Albert Mine**

Permit/Job#: M2011040

PROJECT IDENTIFICATION

Task #: 006
Date: 7/3/2012
User: GRM

State: Colorado
County: Montrose

Abbreviation: None
Filename: M040-006

Agency or organization name: DRMS

UNIT COSTS

Borehole Description	Sealing/Item Method	Diameter	Length	Quantity	Unit	Unit Cost	Total Cost
monitor well	Bentonite seal - 6 in. (labor, equip, materials)	6	435	1.00	EA	$181.28	$181.28
cement plug	Portland cement grout - 6 in. (labor, equip, materials)	6	6	6.00	LF	$10.69	$64.14
utility drop plug	Portland cement grout - 6 in. (labor, equip, materials)	6	6	6.00	LF	$10.69	$64.14
utlility drop - backfill	General laborer - Colorado (total incl. fringes, empl. burden)	6	20	4.00	HR	$26.46	$105.84

Job Hours: **8.00**

Total Cost: **$415.40**

BULLDOZER WORK

Task description: **Grade out stormwater structures**

Site: **Prince Albert Mine**

Permit Action: Initial Reclamation Liability Estimate - 2012

Permit/Job#: M2011040

PROJECT IDENTIFICATION

Task #: 007
Date: 7/3/2012
User: GRM

State: Colorado
County: Montrose

Abbreviation: None
Filename: M040-007

Agency or organization name: DRMS

HOURLY EQUIPMENT COST

Basic Machine: Cat D6T
Horsepower: 185
Blade Type: Semi-Universal
Attachment: 3-shank ripper
Shift Basis: 1 per day
Data Source: (CRG)

Cost Breakdown:

		Utilization %
Ownership Cost/Hour:	$34.23	NA
Operating Cost/Hour:	$57.18	100
Ripper op. Cost/Hour:	$1.40	50
Operator Cost/Hour:	$38.49	NA

Total unit Cost/Hour: $131.30
Total Fleet Cost/Hour: **$131.30**

MATERIAL QUANTITIES

Initial Volume: 1,000
Swell factor: 1.125
Loose volume: **1,125** LCY

Source of estimated volume: Division of Reclamation, Mining & Safety
Source of estimated swell factor: Cat Handbook

HOURLY PRODUCTION

Average push distance: 250 feet
Unadjusted hourly production: 119.6 LCY/hr

Materials consistency description: Consolidated stockpile 1.0

Average push gradient: 10 %
Average site altitude: 5,900 feet

Material weight: 2,550 lbs/LCY

Weight description: Earth - Dry packed

Job Condition Correction Factor		Source
Operator Skill:	0.750	(AVG.)

Material consistency:	1.000	(CAT HB)
Dozing method:	1.000	(GEN.)
Visibility:	1.000	(AVG.)
Job efficiency:	0.830	(1 SHIFT/DAY)
Spoil pile:	0.800	(FND-RF)
Push gradient:	0.786	(CAT HB)
Altitude:	1.000	(CAT HB)
Material Weight:	0.902	(CAT HB)
Blade type:	1.000	(PAT)

Net correction: 0.3531

Adjusted unit production: 42.23 LCY/hr

Adjusted fleet production: **42.23** LCY/hr

JOB TIME AND COST

Fleet size: 1 Dozer(s)

Unit cost: $3.109/LCY

Total job time: **26.64** Hours

Total job cost: **$3,497.83**

BULLDOZER WORK

Task description: **Grade out 3:1 slopes on primary waste pile**

Permit Action: Initial Reclamation Liability Estimate - 2012

Site: **Prince Albert Mine**

Permit/Job#: M2011040

PROJECT IDENTIFICATION

Task #: 008
Date: 7/3/2012
User: GRM

State: Colorado
County: Montrose

Abbreviation: None
Filename: M040-008

Agency or organization name: DRMS

HOURLY EQUIPMENT COST

Basic Machine: Cat D6T
Horsepower: 185
Blade Type: Semi-Universal
Attachment: 3-shank ripper
Shift Basis: 1 per day
Data Source: (CRG)

Cost Breakdown:

		Utilization %
Ownership Cost/Hour:	$34.23	NA
Operating Cost/Hour:	$57.18	100
Ripper op. Cost/Hour:	$1.40	50
Operator Cost/Hour:	$38.49	NA

Total unit Cost/Hour: $131.30
Total Fleet Cost/Hour: **$131.30**

MATERIAL QUANTITIES

Initial Volume: 1,037
Swell factor: 1.335
Loose volume: **1,384** LCY

Source of estimated volume: Division of Reclamation, Mining & Safety
Source of estimated swell factor: Cat Handbook

HOURLY PRODUCTION

Average push distance: 60 feet
Unadjusted hourly production: 409.6 LCY/hr

Materials consistency description: Rock, well ripped or blasted 0.8

Average push gradient: 15 %
Average site altitude: 5,900 feet

Material weight: 2,550 lbs/LCY

Weight description: Sandstone

Job Condition Correction Factor		Source
Operator Skill:	0.750	(AVG.)

Material consistency:	0.800	(CAT HB)
Dozing method:	1.000	(GEN.)
Visibility:	1.000	(AVG.)
Job efficiency:	0.830	(1 SHIFT/DAY)
Spoil pile:	0.800	(FND-RF)
Push gradient:	0.666	(CAT HB)
Altitude:	1.000	(CAT HB)
Material Weight:	0.902	(CAT HB)
Blade type:	1.000	(PAT)

Net correction: 0.2393

Adjusted unit production: 98.02 LCY/hr
Adjusted fleet production: **98.02** LCY/hr

JOB TIME AND COST

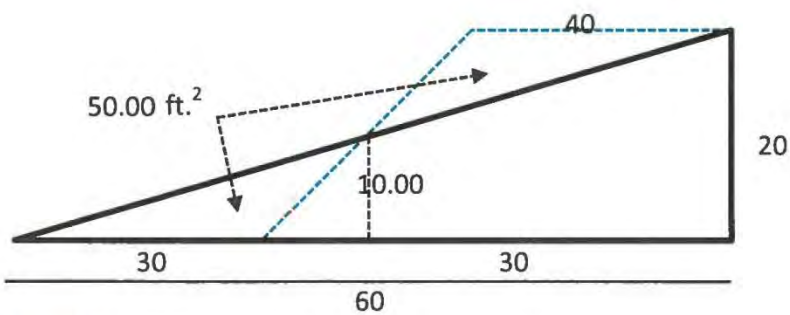
Fleet size: 1 Dozer(s)
Unit cost: $1.340/LCY

Total job time: **14.12** Hours
Total job cost: **$1,854.44**

Highwall reduction - cut and fill

Highwall Height (ft.)	20	
Length of Highwall (lft.)	560	
Initial Slope	2	H:1V
Desired Slope	3	H:1V
Volume of material to be moved (ft.^{3})	**28,000**	
Volume of material to be moved (yd.^{3})	**1,037**	

All dimensions measured in feet
Drawing not to scale



PRIMARY
WASTE Pile
Slope Reduction

BULLDOZER RIPPING WORK

Task description: **Rip access roads, utility, and waste pile compacted areas**

Permit Action: Initial Reclamation Liability Estimate - 2012

Site: **Prince Albert Mine**

Permit/Job#: M2011040

PROJECT IDENTIFICATION

Task #: 009
Date: 7/3/2012
User: GRM

State: Colorado
County: Montrose

Abbreviation: None
Filename: M040-009

Agency or organization name: DRMS

HOURLY EQUIPMENT COST

Basic Machine: Cat D6T
Ripper Attachment: 3-Shank Ripper

Horsepower: 185
Shift Basis: 1 per day
Data Source: (CRG)

Cost Breakdown:

		Utilization %
Ownership Cost/Hour:	$34.23	NA
Operating Cost/Hour:	$57.18	100
Ripper Operating Cost/Hour:	$2.81	100
Operator Cost/Hour:	$38.49	NA
Total Unit Cost/Hour:	$132.71	
Total Fleet Cost/Hour:	**$132.71**	

MATERIAL QUANTITIES

Selected estimating method: Area

Alternate Methods:

Seismic: NA
Area: 2.50 acres

Bank Volume: NA BCY
Rip Depth (ft): 1.00
Volume: 4,033 BCY or CCY

NA

Source of estimated quantity: Reclamation maps and plans

HOURLY PRODUCTION

Seismic:

Seismic Velocity: NA feet/second

Area:

Average Ripping Depth:	1.64	mph
Average Ripping Width:	6.58	degrees
Average Ripping Length:	150.00	feet
Average Dozer Speed:	88.00	feet
Average Maneuver Time:	0.25	feet
Production per unit area:	0.696	acres/hour

Job Condition Correction Factors

Unadjusted Hourly Unit Production:	0.696	Acres/hr
Site Altitude:	5,900	feet
Altitude Adj:	1.00	(CAT HB)
Job Efficiency:	0.83	(1 shift/day)
Net Correction:	0.83	multiplier
Adjusted Hourly Unit Production:	0.58	Acres/hr
Adjusted Hourly Fleet Production:	**0.58**	Acres/hr

JOB TIME AND COST

Fleet size: 1 Grader(s)

Total job time: **4.33** Hours

Unit cost: $229.875 Per acre

Total job cost: **$575.00**

CIRCES Cost Estimating Software

WHEEL LOADER – LOAD AND CARRY WORK

Task description: **Spread topsoil over site**

Permit Action: Initial Reclamation Liability Estimate - 2012

Site: **Prince Albert Mine**

Permit/Job#: M2011040

PROJECT IDENTIFICATION

Task #: 010
Date: 7/3/2012
User: GRM

State: Colorado
County: Montrose

Abbreviation: None
Filename: M040-010

Agency or organization name: DRMS

HOURLY EQUIPMENT COST

Basic Machine: CAT 446D
Attachment 1: ROPS Cab

Horsepower: 101
Shift Basis: 1 per day
Data Source: (CRG)

Cost Breakdown:

		Utilization %
Ownership Cost/Hour:	$17.87	NA
Operating Cost/Hour:	$29.61	100
Operator Cost/Hour:	$38.49	NA
Total Unit Cost/Hour:	$85.97	
Total Fleet Cost/Hour:	$85.97	

MATERIAL QUANTITIES

Initial volume: 2,500 CCY
Loose volume: **2,500** LCY

Swell factor: 1.000

Source of estimated volume: Division of Reclamation, Mining & Safety
Source of estimated swell factor: Cat Handbook

HOURLY PRODUCTION

Loader Cycle Time: Unadjusted Basic Cycle Time (load, dump, maneuver): 0.475 minutes

Cycle Time Factors		Factor (min.)	Source
Material:	Mixed material 0.02	0.020	(Cat HB)
Stockpile:	No adjustment - factor not applicable 0.00	0.000	(Cat HB)
Truck Ownership:	No adjustment - factor not applicable 0.00	0.000	(Cat HB)
Operation:	Inconsistent operation 0.04	0.040	(Cat HB)
Dump Target:	Fragile target 0.05	0.050	(Cat HB)
	Net Cycle Time Adjustment:	0.110	minutes
	Adjusted Basic Cycle Time:	0.585	minutes

Rolling Resistance – Road Conditions

Haul: Rutted dirt, little maintenance, no water, 1" tire penetration 4.0
Return: Rutted dirt, little maintenance, no water, 1" tire penetration 4.0

Haul and Return Time

	Length (feet)	Grade Res. (%)	Rolling Res. (%)	Total Res. (%)	Travel Time (minutes)	Source
Haul Route:	250	0.00	4.00	4.00	0.1587	(Cat HB)

Return Route:	250	0.00	4.00	4.00	0.1587	(Cat HB)

Total Travel Time: 0.3174 minutes
Total Cycle Time: **0.9024** minutes

Load Bucket Capacity

Rated Capacity:	1.50	LCY (heaped)
Bucket Fill Factor:	1.100	Other - rock/dirt mixtures (100-120%) 1.100
Adjusted Capacity:	**1.65**	LCY

Job Condition Correction Factors
Site Altitude: 5900 feet

		Source
Altitude Adj:	1.00	(CAT HB)
Job Efficiency:	0.83	(1 shift/day)
Net Correction:	0.83	multiplier

Unadjusted Hourly Unit Production:	109.71	LCY/Hour
Adjusted Hourly Unit Production:	91.06	LCY/Hour
Adjusted Hourly Fleet Production:	**91.06**	LCY/Hour

JOB TIME AND COST

Fleet size:	1	Loader(s)	Total job time:	**27.45**	Hours
Unit cost:	$0.944	/LCY	Total job cost:	**$2,360.00**	

BULLDOZER WORK

Task description: **Grade out 3:1 slopes on secondary waste pile**

Site: **Prince Albert Mine**

Permit Action: Initial Reclamation Liability Estimate - 2012

Permit/Job#: M2011040

PROJECT IDENTIFICATION

Task #: 011
Date: 7/5/2012
User: GRM

State: Colorado
County: Montrose

Abbreviation: None
Filename: M040-011

Agency or organization name: DRMS

HOURLY EQUIPMENT COST

Basic Machine: Cat D6T
Horsepower: 185
Blade Type: Semi-Universal
Attachment: 3-shank ripper
Shift Basis: 1 per day
Data Source: (CRG)

Cost Breakdown:

		Utilization %
Ownership Cost/Hour:	$34.23	NA
Operating Cost/Hour:	$57.18	100
Ripper op. Cost/Hour:	$1.40	50
Operator Cost/Hour:	$38.49	NA

Total unit Cost/Hour: $131.30
Total Fleet Cost/Hour: **$131.30**

MATERIAL QUANTITIES

Initial Volume: 500
Swell factor: 1.335
Loose volume: **668** LCY

Source of estimated volume: Division of Reclamation, Mining & Safety
Source of estimated swell factor: Cat Handbook

HOURLY PRODUCTION

Average push distance: 60 feet
Unadjusted hourly production: 409.6 LCY/hr

Materials consistency description: Rock, well ripped or blasted 0.8

Average push gradient: 15 %
Average site altitude: 5,900 feet

Material weight: 2,550 lbs/LCY

Weight description: Sandstone

Job Condition Correction Factor		Source
Operator Skill:	0.750	(AVG.)

Material consistency:	0.800	(CAT HB)
Dozing method:	1.000	(GEN.)
Visibility:	1.000	(AVG.)
Job efficiency:	0.830	(1 SHIFT/DAY)
Spoil pile:	0.800	(FND-RF)
Push gradient:	0.666	(CAT HB)
Altitude:	1.000	(CAT HB)
Material Weight:	0.902	(CAT HB)
Blade type:	1.000	(PAT)

Net correction: 0.2393

Adjusted unit production: 98.02 LCY/hr
Adjusted fleet production: **98.02** LCY/hr

JOB TIME AND COST

Fleet size: 1 Dozer(s)
Unit cost: $1.340/LCY

Total job time: **6.81** Hours
Total job cost: **$894.14**

BULLDOZER WORK

Task description: **Spread topsoil secondary waste pile**

Permit Action: Initial Reclamation Liability Estimate - 2012

Site: **Prince Albert Mine**

Permit/Job#: M2011040

PROJECT IDENTIFICATION

Task #: 012
Date: 7/5/2012
User: GRM

State: Colorado
County: Montrose

Abbreviation: None
Filename: M040-012

Agency or organization name: DRMS

HOURLY EQUIPMENT COST

Basic Machine: Cat D6T
Horsepower: 185
Blade Type: Semi-Universal
Attachment: 3-shank ripper
Shift Basis: 1 per day
Data Source: (CRG)

Cost Breakdown:

		Utilization %
Ownership Cost/Hour:	$34.23	NA
Operating Cost/Hour:	$57.18	100
Ripper op. Cost/Hour:	$1.40	50
Operator Cost/Hour:	$38.49	NA

Total unit Cost/Hour: $131.30
Total Fleet Cost/Hour: **$131.30**

MATERIAL QUANTITIES

Initial Volume: 500
Swell factor: 1.250
Loose volume: **625** LCY

Source of estimated volume: Division of Reclamation, Mining & Safety
Source of estimated swell factor: Cat Handbook

HOURLY PRODUCTION

Average push distance: 75 feet
Unadjusted hourly production: 357.1 LCY/hr

Materials consistency description: Partly consolidated stockpile 1.1

Average push gradient: 15 %
Average site altitude: 5,900 feet

Material weight: 2,550 lbs/LCY

Weight description: Earth - Dry packed

Job Condition Correction Factor

		Source
Operator Skill:	0.750	(AVG.)

Material consistency:	1.100	(CAT HB)
Dozing method:	1.000	(GEN.)
Visibility:	1.000	(AVG.)
Job efficiency:	0.830	(1 SHIFT/DAY)
Spoil pile:	0.800	(FND-RF)
Push gradient:	0.666	(CAT HB)
Altitude:	1.000	(CAT HB)
Material Weight:	0.902	(CAT HB)
Blade type:	1.000	(PAT)

Net correction: 0.3291

Adjusted unit production: 117.52 LCY/hr

Adjusted fleet production: **117.52** LCY/hr

JOB TIME AND COST

Fleet size: 1 Dozer(s)

Unit cost: $1.117/LCY

Total job time: **5.32** Hours

Total job cost: **$698.29**

REVEGETATION WORK

Task description: **Revegetation of 5 acres of disturbed lands**

Permit Action: Initial Reclamation Liability Estimate - 2012

Site: **Prince Albert Mine**

Permit/Job#: M2011040

PROJECT IDENTIFICATION

Task #: 013
Date: 7/5/2012
User: GRM

State: Colorado
County: Montrose

Abbreviation: None
Filename: M040-013

Agency or organization name: DRMS

FERTILIZING

Materials

Description	Units / Acre	Unit	Cost / Unit	Cost /Acre
None required			$	$
			Total Fertilizer Materials Cost/Acre	**$0.00**

TILLING

Description	Cost /Acre
Chisel plowing {DMG}	$86.71
Disc harrowing, 6" deep (MEANS 32 91 13.23 6100)	$92.35
Total Tilling Cost/Acre	**$179.06**

SEEDING

Seed Mix	Rate – PLS LBS / Acre	Seeds per SQ. FT	Cost /Acre
Blue Grama - Hachita	0.60	9.79	$6.25
Indian Ricegrass - Paloma	2.80	9.06	$23.88
Crested Wheatgrass - Nordan	2.00	9.18	$4.56
Pubescent Wheatgrass - Luna	4.00	8.26	$8.76
Slender Wheatgrass - Pryor	2.60	9.49	$7.85
Milk Vetch, Cicer - Lutana	0.40	1.33	$1.99
Western Wheatgrass - Arriba	3.60	9.09	$12.96
Needle and Thread	3.20	8.45	$147.20
Flax, Lewis Blue	1.00	6.63	$16.17
Saltbush, Four Wing	4.00	5.51	$42.00
Penstemon, Palmer	0.20	4.42	$6.07
Totals Seed Mix	24.40	81.23	**$277.69**

Application

Description	Cost /Acre
Broadcast seeding [DMG]	$255.76
Total Seed Application Cost/Acre	**$255.76**

MULCHING and MISCELLANEOUS

Materials

Description	Units / Acre	Unit	Cost / Unit	Cost /Acre
Herbicide - Curtail @ 4.0 pt/ac	1.00	ACRE	$15.90	$15.90
Straw, delivered {MEANS 31 25 14.16 1200}	1.50	TON	$164.00	$246.00
Total Mulch Materials Cost/Acre				**$261.90**

Application

Description	Cost /Acre
Crimping, with tractor {DMG survey data}	$65.89
Power mulcher (MEANS 32 91 13.16 0250)	$79.71
Weed spray, hand, non-aquatic area, nox. [DMG]	$175.77
Total Mulch Application Cost/Acre	**$321.37**

NURSERY STOCK PLANTING

Common Name	No / Acre	Type and Size	Planting Cost	Fertilizer Pellet Cost	Cost /Acre
None required					$
Totals Nursery Stock Cost / Acre					**$0.00**

JOB TIME AND COST

No. of Acres: 5 Cost /Acre: $1,295.78
Estimated Failure Rate: 50% Cost /Acre*: $1,295.78
*Selected Replanting Work Items: TILLING,SEEDING,MULCHING

Initial Job Cost: **$6,478.90**
Reseeding Job Cost: **$3,239.45**
Total Job Cost: **$9,718.35**
Job Hours: **24.00**

EQUIPMENT MOBILIZATION/DEMOBILIZATION

Task description: **Mobilization ot site**

Permit Action: Initial Reclamation Liability Estimate - 2012

Site: **Prince Albert Mine**

Permit/Job#: M2011040

PROJECT IDENTIFICATION

Task #: 014
Date: 7/5/2012
User: GRM

State: Colorado
County: Montrose

Abbreviation: None
Filename: M040-014

Agency or organization name: DRMS

EQUIPMENT TRANSPORT RIG COST

Shift basis: 1 per day
Cost Data Source: CRG Data

Truck Tractor Description: GENERIC ON-HIGHWAY TRUCK TRACTOR, 6X4, DIESEL POWERED, 400 HP (2ND HALF, 2006)

Truck Trailer Description: GENERIC FOLDING GOOSENECK, DROP DECK EQUIPMENT TRAILER (25T, 50T, AND 100T)

Cost Breakdown:

Available Rig Capacities	0-25 Tons	26-50 Tons	51+ Tons
Ownership Cost/Hour:	$16.63	$18.37	$22.33
Operating Cost/Hour:	$44.38	$46.13	$50.07
Operator Cost/Hour:	$27.66	$27.66	$27.66
Helper Cost/Hour:	$0.00	$25.39	$25.39
Total Unit Cost/Hour:	$88.67	$117.55	$125.45

NON ROADABLE EQUIPMENT:

Machine Description	Weight/ Unit (TONS)	Owner ship Cost/hr/ unit	Haul Rig Cost/hr/unit	Fleet Size	Haul Trip Cost/hr/ fleet	Return Trip Cost/hr/ fleet	DOT Permit Cost/ fleet
CAT 246C	3.58	$6.39	$88.67	1	$95.06	$88.67	$0.00
CAT 446D	9.80	$17.87	$88.67	1	$106.54	$88.67	$0.00
Cat D6T	25.01	$34.23	$88.67	1	$122.90	$88.67	$250.00
Drill/Broadcast Seeder with Tractor	25.00	$39.59	$88.67	1	$128.26	$88.67	$0.00
Power Mulcher (Reinco M90)	6.00	$7.03	$88.67	1	$95.70	$88.67	$0.00
				Subtotals:	**$548.46**	**$443.35**	**$250.00**

ROADABLE EQUIPMENT:

Machine Description	Total Cost/hr/ unit	Fleet Size	Haul Trip Cost/hr/ fleet	Return Trip Cost/hr/ fleet
Water Tanker, 3,500 Gal.	$69.00	1	$69.00	$69.00
Light Duty Pickup, 4x4, 3/4 T.	$54.12	1	$54.12	$54.12
Flatbed Truck, 4x2, 30K GVW	$62.73	1	$62.73	$62.73
		Subtotals:	**$185.85**	**$185.85**

EQUIPMENT HAUL DISTANCE and Time

Nearest Major City or Town within project area region:	NUCAL	
Total one-way travel distance:	18.00	miles
Average Travel Speed:	40.00	mph
Total Non-Roadable Mob/Demob Cost * '* two round trips with haul rig:	$2,489.55	
Total Roadable Mob/Demob Cost ** ** one round trip, no haul rig:	$167.27	

Transportation Cycle Time:

	Non-Roadable Equipment	Roadable Equipment
Haul Time (Hours):	0.45	0.45
Return Time (Hours):	0.45	0.45
Loading Time (Hours):	0.50	NA
Unloading Time (Hours):	0.50	NA
Subtotals:	1.90	0.90

JOB TIME AND COST

Total job time:	**3.80**	Hours
Total job cost:	**$2,656.82**	