APPENDIX 5-6

Reclamation Bond Estimate

Bonding Calculations

Direct Costs		
Subtotal Demolition and Removal	$1,127,482.00	
Subtotal Backfilling and Grading	$827,141.00	
Subtotal Revegetation	$474,272.00	
Direct Costs	$2,428,895.00	
Indirect Costs		
Mob/Demob	$242,890.00	10.0%
Contingency	$121,445.00	5.0%
Engineering Redesign	$60,722.00	2.5%
Main Office Expense	$165,165.00	6.8%
Project Mainagement Fee	$60,722.00	2.5%
Subtotal Indirect Costs	$650,944.00	26.8%
Total Cost	$3,079,839.00	
Escalation factor		0.016
Number of years		2
Escalation	$99,343.00	
Reclamation Cost Escalated	$3,179,182.00	
Reclamation Cost (rounded to nearest $1,000) 2010 Dollars	$3,179,000.00	
Bond in 2010 dollars	$3,300,000.00	
Difference Between Cost Estimate and Bond	$121,000.00	
Percent Difference	3.81%	

Ref.	Description	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Mine Belt BC-1 No 1																		19359
	Transfer Building No 2																		34970
	Feed Belt BC 2 No3																		13812
	Stack Tubes 2 No4																		3673
	Head House 1 No 5																		6687
	Transfer Belt BC 2 No 6																		8800
	Head House 2 No 7																		1632
	Reclaim Tunnel No 8																		33969
	Reclaim Belt BC 4 No 9																		12015
	Escape Tunnel 60 inch No 10																		953
	Crusher Building No 11																		31287
	Truck Loadout Belt BC 5 No 12																		9946
	Truck Loudout and Scale No 13																		25633
	Bathhouse No 14																		138047
	Substation No 15																		1803
	Power Lines and Poles No 16																		1958
	Retaining Wall No 17																		698
	Gabion Wall No 18																		59675
	Pump House No 19																		2708
	Paved Road No 20																		141491
	Stream Culvert 72 inch No 21																		46216
	Water Tanks No 22																		3097
	Rock Dust Bin No 23																		1092
	Fuel Tank and Fuel Station No 24																		1615
	Holding Tank No 25																		331
	Ventilation Fan No 26																		2260
	Magnet 27																		491
	Water System 28																		73801
	Sewage System 29																		24734
	Item 30 removed																		
	Storage Containers 31																		9800
	Gilson Well No 32																		1517
	Shop Building No 33																		5053
	Switch House No 34																		1035
	Portals No 35																		26000
	Storage Building No 36																		1795
	Sampling System No 37																		1335
	Stoker Storage Bin No 41																		822
	Substation No 2 No 42																		2654
	Gabion Baskets No 43																		982
	Pace Fan Culvert																		2031
	Pace Fan Generator																		52771
	Pace Fan Portal																		5200
	Refuse Site No 44																		9913
	Degas Well G2																		12297
	Degas Well G3																		7990
	Degas Well G4																		7670
	Degas Well G5																		11058
	Degas Well G6																		8324
	Degas Well G7																		12314
	Degas Well G9																		11054
	Degas Well G10																		2301
	Degas Well G11																		9287
	Degas Well G12																		9081
	Degas Well G13																		13065
	Degas Well G14																		12924
	Degas Well G15																		11354
	Degas Well G16																		10369
	Degas Well G17																		10043
	Degas Well G18																		21638
	Degas Well G19																		13857
	Degas Well G31																		27825
	AMV Road																		67999
	Degas Well G22 & Road																		23373
	Total																		1127482

Ref.	Description	Materials	Means Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Degas Well G22 and Access Road																			
	Grade and Backfill	Front end loader	02315 424	1.43	/CY						7386					CY		7386	CY	10562
	Fill in Mud Pit	Backfill Trench M	02315 610	1.58	/CY						430					CY		430	CY	679
	Subtotal																			11241
	Plug Well Casing	Concrete Ready	03310 220	196	/CY						25					CY		25	CY	4900
	Subtotal																			4900
	Spread Topsoil	Front end loader	02315 424	1.43	/CY						2103					CY		2103	CY	3007
	Subtotal																			3007
	Fence (only pad)																			
	Remove Barbed Wire	Fencing Barbed \	02220 220	1.59	/LF	1300										FT		1300	FT	2067
	Subtotal																			2067
	Support																			
	Pickup Truck	Pickup Rental	01 54 33 4	80.42	/day									24		hr		3	day	241
	Foreman	Foreman Averag	Foreman	$59.90	HR									32		hr		32	hr	1917
	Subtotal																			2158
	Total																			23373

Ref.	Description	Materials	Reference Number	Unit Cost	Unit	Length	Width	Height	Diameter	Area	Volume	Weight	Density	Time	Number	Unit	Swell Factor	Quantity	Unit	Cost
	Degas Well G-22 and Access Road																			
	Soil Preparation																			
	Pocking	Excavation Bulk Bank 2 CY (322BL)	M023154240260	1.74	/CY					1.6						AC		2581	CY	4491
	Subtotal																			4491
	Seed Mix No 1																			
	Hydroseed Equipment and Labor	Hydro Spreader (equip. & labor) B-81 80MS	Reveg002	19.8	/MSF					1.6						AC		70	MSF	1386
	Hydroseed Material	Dugout Seed Mix No 1	Dugout 07391S	394.75	/AC					1.6						AC		1.6	AC	632
	Hay Mulch	Hay 1" material only 029105000250	Reveg001	69.85	/MSF					1.6						AC		1.6	ton/AC	112
	Subtotal																			2130
	Direct Vegetation																			6621
	Reseeding																			
	Volume 1 Worksheet																			1252
	Total																			7873

CHAPTER 2

SOILS

TABLE 2-1

Topsoil Volumes*

Well No.	Cubic Yards of Material
G-1	415
G-2	3,104
G-3	1,182
G-4	1,100
G-5	1,909
G-6	792
G-7	1251
G-8	543
G-9	1,574
G-10	2,344
G-11	254
G-12	563
G-13	2,162
G-14	1,544
G-15	1,475
G-16	1,092
G-17	797
G-18	2,195
G-19	2,037
G-22 & Access Road	2,103
G-31	4,624
Access Road	9,167

* These total do not include soil salvaged from short roads accessing well sites which is bladed to the side of the road.

224 Substitute Topsoil

Dugout Canyon does not plan to use substitute topsoil as growth media except as described in Section 222.400.

230 OPERATION PLAN

231 General Requirements

231.100 Removing and Storing Topsoil Methods

The topsoil will be removed, stockpiled and protected with a berm and/or silt fence. A qualified person will be on site during soil salvage to monitor and supervise the operation for the purpose of maximizing salvage volumes. Prior to topsoil salvage shrubs/vegetation will be removed and placed/wind rowed along the inside perimeter of the disturbed area.

After the topsoil is removed, the mud pit will be excavated and the soils from the mud pit excavation will be stored immediately adjacent to the mud pit. Mud pit excavation of subsoil will be approximately 110 CY at each well site (G-2 thru G-6).

The subsoil excavation for the mud pits at G-7 thru G-19, G-22, and G-31 was approximately 430 CY. A portable container for drilling fluids will be used if necessary, should there not be sufficient subsoil depth to excavate a mud pit.

Topsoil beneath the topsoil stockpiles will not be removed. Ribbon or a marking fabric will be placed on top of the topsoil prior to placement of the topsoil from the well pad area.

The approximate volume of subsoil to be salvaged and used to create berms around the perimeter of the well site including the topsoil stockpile perimeter is: G-1 - 161 CY; G-2 - 254 CY, G-3 - 208

CY, G-4-165 CY, G-5 - 191 CY, G-6 - 156 CY, G-7 - 107 CY, G-8 - 143 CY, G-9 - 182 CY, G-10 - 137 CY, G-11 - 185 CY, G-12 - 260 CY, G-13 - 142 CY, G-14A - 123 CY, G-15 - 101 CY, G-16 - 98 CY, G-18 - 39 CY excludes topsoil pile, G-19 - 48 CY, G-22 and Access Road - 140 CY, G-31 - 62 CY excludes topsoil pile, Topsoil Stockpiles T-2 thru T10 - 300 CY and Access Road - 248 CY.

At the G-19 drill pad there is a variance between the disturbed area acreage and the acreage where topsoil will be salvaged. Portions of the site have no topsoil, due to previous disturbance by logging, these areas include roads, a gully and skid trails. In addition there is a perimeter buffer area that will not be disturbed and thus will not have topsoil removed from the area unless it becomes necessary due to unforseen issues during construction, such as buried outcrops, large boulders, tree root systems, etc. An area within the northeastern portion of the disturbed area has two road forks extending from the end of the existing road, these two forks have no topsoil on them and the area between them will not be disturbed and therefore will not have topsoil salvaged. A sketch of these areas is located in Attachment 2-1.

There is a difference between the topsoil volumes totals and the estimated inches to be salvaged on pads G-18, G-31 and the AMV road. The topsoil volume totals assume that the entire disturbed area will be stripped of 12 inches of topsoil/growth medium. Any areas within the disturbed area boundary which can remain undisturbed will remain undisturbed. In addition, the soils to be salvaged are assumed to be the same depth as the test pit or 12 inches. The available soil for salvage is likely to vary throughout the areas to be salvaged. A commitment is made to salvage available topsoil or 12 inches of growth medium. Sketches of the well pads are included in Attachment 2-1.

The topsoil for the G-22 pad and access road will be stored on the permitted pad of either G-16 or G-17. The determination will need to be made at the time of removal and dependent upon the access to G-17, considering weather conditions. If the topsoil can be removed prior to winter snows it will be stored on G-17, if there is snow and access to G-17 is restricted, the topsoil will be stored on drill pad G-16. There will be no new disturbance in the G-17 pad area, the soils will be

stored on a wide turnout on an existing road in an area immediately adjacent to an existing soil stockpile placed on the turnout by the landowner. The topsoil pile will be bermed and protected as are the other stockpiles associated with degas holes and roads.

231.200 Suitability of Topsoil Substitutes/Supplements

See Section 224.

231.300 Testing of Topsoil Handling and Reclamation Procedures Regarding Revegetation

Dugout will exercise care to guard against erosion during and after application of topsoil and will employ the necessary measures to ensure the stability on graded slopes. Erosion control measures will include silt fences, berms, seeding, straw bales, soil roughening, and mulching of the soils.

Topsoil will be redistributed and the original soil surface beneath the topsoil stockpile will be roughened as presented in Section 242.100 and seeded with the seed mix described in Chapter 3, Section 352.

Methods used to evaluate success of revegetation and stabilization are discussed in Chapter 3, Section 356.

231.400 Construction, Modification, Use, and Maintenance of Topsoil Storage Pile

Topsoil removed from the drill pad sites will be stockpiled on the site, except at well site G-14 where it will be stockpiled approximately 1/10 mile away. The estimated volumes of topsoil stockpile for each site are shown in Table 2-1. The stockpiles will be sized as shown in Table 2-2.

The slopes of the stockpile will be 1H:1V or approximately 45^0 during the construction phase. Soils in these areas generally have an angle of repose greater than 50 degrees, making a stockpile with 1:1 slopes feasible. The steeper slope also help minimize the area to be disturbed. When space is available topsoil will be stockpiled with slopes of 2H:1V.

232 Topsoil and Subsoil Removal

232.100 Topsoil Removal and Segregation

All topsoil will be removed as a single layer with no segregation. Topsoil will be removed using a dozer and/or loader. Refer to Section 231.100 for additional details.

232.200 Poor Topsoil

No poor soils exist at the well sites see Attachment 2-1.

232.300 Thin Topsoil

Not applicable see Attachment 2-1.

232.400 Minor Disturbances Not Requiring Topsoil Removal

Topsoil will not be removed along the fence line at the wells sites.

232.500 Subsoil Segregation

The B and C soil horizons will not be removed. Any small quantity of subsoil removed with the topsoil will not be segregated.

TABLE 2-2

Topsoil Stockpile Dimensions*

Well No.	Length (ft)	Width (ft)	Height (ft)
G-1	55	35	16
G-2	156	50	20
G-3	70	60	17
G-4	110	35	17
G-5	90	65	21
G-6	105	30	13
G-7	80	70	6 to12
G-8	168	60	6
G-9	160	90	30
G-10	170	80	65
G-11	40	50	12
G-12	60	80	18
G-13	120	100	17
G-14A	120	60	11

TABLE 2-2 (Continued)

Topsoil Stockpile Dimensions*

Well No.	Description	Length (ft)	Width (ft)	Height (ft)
G-15	Pad	90	90	19
G-16	Pad	100	80	12
G-17	Pad	85	55	10
G-18	T-10	118	80	20
G-19	Lower Road	235	8	5
	Pad	140	52	35
G-22 and Access Road	Pad & road, ~~Stored on G-16~~	85	65	12
G-31	T-8	85	67	7
	T-9	128	100	13
Access Road	T-2	40	90	8
	T-3	108	95	11
	T-4	12	45	5
	T-5	95	110	13
	T-6	95	138	14
	T-7	110	150	21

~~* These are approximate dimensions of the topsoil stockpile and construction dimensions may vary.~~ *The height represents the elevation difference between the lowest point and highest point of the topsoil stockpile. The topsoil thickness will vary with the slope of the native ground surface. When stored on steep slopes the topsoil thickness will be much less than the estimated height of the stockpile.

See Section 234.200 for detailed information on the topsoil stockpile(s).

surface pitted, gouged and/or roughened and revegetated using the grass seeds listed in Table 3-2 to prevent wind erosion.

Topsoil Redistribution - Stockpile soil will not be moved until redistribution during contemporaneous or final reclamation operations unless approved by the Division.

At well pad G-19 a portion of the salvaged topsoil will be stored on a fork of the existing road. There is no topsoil remaining on the road and the road will remain following reclamation of the G-19 pad site. Wide flagging will be used as a marker to identify the separate between the road surface and the stored topsoil. Landowner correspondence pertaining to topsoil storage on the existing road is contained in Attachment 2-3.

Cross-sections of topsoil piles T-2 thru T-10 are shown on Plate 3, in Attachment 5-4. As-built cross sections with horizontal and vertical scales equal with two perpendicular cross sections provided for each of the topsoil stockpiles ~~will be submitted within 30 days following the completion of the construction of topsoil stockpiles~~ T-2 thru T-10 (Attachment 5-4, Plate 3). The perpendicular cross sections will extend through the area where the stockpiles join the road, except T-8, T-9 and T-10 which do not join a road but are on degas well pads.

To minimize the area of disturbance for well pad G-22 the topsoil for the pad and access road will stored as described in Section 231.100.

234.300 Topsoil Stockpile Relocation

Stockpiled soil in jeopardy of being detrimentally affected in terms of its quantity and quality by drilling operations may be temporarily redistributed or relocated on approval by the Division and modification of this M&RP.

240 RECLAMATION PLAN

As-built cross section where both horizontal and vertical scales are equal and an as-built road profile were ~~will be~~ provided ~~within 30 days of~~ following completion of the AMV road construction. The AMV as-built road cross sections are provided on Plates 2 and 3 in Attachment 5-4. ~~In addition, an as-built road profile will be provided within 30 days of completion of the AMV road construction.~~

241 General Information

Reclamation of the degassification sites (topsoil redistribution, amendments, and stabilization) is discussed in Sections 242, 243, and 244 respectively.

242 Soil Redistribution

242.100 Soil Redistribution Practices

The topsoil will be placed after recontouring of the site has occurred. Topsoil will be handled when they are loose or in a friable condition. The moisture content will be visually monitored and water will be added as needed to enhance the soil's condition for handling. The approximate amount of topsoil available for each site is shown in Table 2-1. The reclamation time line can be found on Figure 5-15 for sites G-2 and G-3 and on Figure 5-26 for sites G-4 thru G-19, G-22 (including access road) and G-31. Figure 5-26 has been revised to include the access road (AMV).

The topsoil will be distributed in two phases at well site G-2, the first phase will be the contemporaneous reclamation of a portion of the pad area used during well construction (see Figures 5-4, 5-8 and 5-12). During contemporaneous reclamation topsoil from the stockpile will be distributed in the depths shown in Table 2-3.

Final reclamation will occur at all well sites after venting of the methane gas is complete, venting equipment has been removed and the well has been plugged. Well plugging will be delayed at well

ATTACHMENT 2-1
SOIL INVENTORY AND ASSESSMENT

add to the back of existing information

Ryan Sweetwood
140E 600N #2
Provo, UT 84606
847-877-6925

January 24, 2008

Ms. Vicky Miller
Dugout Canyon Mine
PO Box 1029
Wellington, Utah 84542

Dear Ms. Miller,

This letter and report summarize the methodology and the results of the soil survey conducted in November 2007 at Dugout Mine. Thirteen (13) soil profiles within Dugout's permitted area were investigated.

NRCS Soil Data

All soil survey maps were created using the Natural Resources Conservation Services' (NRCS) Web Soil Survey (WSS) software. The survey maps represent the relative position of the soil pit and the soil series to which it is designated by the NRCS.

Site Reconnaissance

Each site was initially walked with Vicky Miller and potential location and number of soil pits was noted. Most soil pits were within a couple hundred feet of road access but for the most part had little to no recent human disturbances except for SP-6, which was logged.

Soil Test Pits

Soil pits SP1 through SP13 were excavated on November 13 and 14, 2007, and they are representative of the area of several potential well sites for the Dugout Mine: G-21, G-22, G-35, G-34, and G-33. Field observations included color using a Munsell color chart (10YR), structure, horizon depth, GPS coordinates, photographs, and an approximated map of vegetation and surface features for each site. Soil pits were excavated by hand until bedrock or until penetration became very difficult. All soil samples were collected in a plastic bag and shipped immediately for analysis. Appendix A contains the soil profile descriptions. Appendix B has photographs of each profile. Appendix C contains the maps generated by WSS and the soil series descriptions. Appendix D has the laboratory analyses. Appendix E has hand-drawn maps of surface features and vegetation for each site.

Soil profiles SP-1, SP-4, SP-11, and SP-12 closely match the soil series designated in the WSS. However, for reasons stated below, all other soil profiles more closely match competing soil series.

Soil profiles SP-1, SP-4, SP-11, and SP-12 closely match the soil series designated in the WSS. However, for reasons stated below, all other soil profiles more closely match competing soil series.

SP-2, SP-13 – They are shallow with an argillic horizon, which is not characteristic of Rottulee Series. Physical and chemical properties match the Beje Series. The Beje Series' description is provided in Appendix C.

SP-3 – This profile is shallow, has a high percentage of sand, and is slightly acidic, which are not characteristic of Senchert Series. This profile shares more properties with the Miracle Series. The Miracle Series has in similar depth to bedrock, an argillic horizon, and texture. The pH is slightly lower in the soil profile than the Miracle Series and the soil profile lacks a BA horizon. The Miracle Series' description is provided in Appendix C.

SP-5, SP-6, SP-7, SP-8 – These profiles shared the same properties and are found on the same north slope. They are black to dark brown, have no argillic horizons, and are slightly acidic, all of which are not characteristic of Senchert Series. None of the slightly acidic series in Carbon or Emery Counties fit these profiles. These profiles are unique. Bachus and Senchert Series are competing series for this region. They share some but not all properties of these profiles. The Bachus Series' description is provided in Appendix C.

SP-9 – This profile has an argillic horizon, is non-calcareous, and is neutral, which are not characteristic of Rottulee Series. This profile shares more properties with the Senchert Series. The Senchert Series has in similar depth to bedrock, argillic horizons, texture, and pH. The color in this soil profile is slightly darker than the Senchert Series. The Senchert Series' description is provided in Appendix C.

SP-10 – This profile has an argillic horizon, which is not characteristic of Rottulee Series. The colors of the B horizons contrast greatly between each other. The presence of many converging drainages and steep slopes suggest that there may have been periodic mass deposits from different sources of parent material. On either side of this site, soils appeared to pertain to Rottulee Seires. Physical and chemical properties match more closely to the Stubbs Series. However, this profile lacks the AB horizon. The Stubbs Series' description is provided in Appendix C.

Please feel free to contact me with any questions or concerns. It was a pleasure to work with you.

Sincerely,

Ryan Sweetwood

Ryan Sweetwood

Telephone: 847-877-6925
Email: rvsweetwood@msn.com
Address: 210 Wymount Ter Provo, UT 84604

Education

- BS Environmental Soil Science, Brigham Young University, 2006 – GPA 3.6
- MS Agronomy, Brigham Young University, December, 2007

Related Courses

- Hydrogeology
- Geology
- Environmental Soil Chemistry
- Hazardous Waste Management
- Environmental Case Studies
- Soil Taxonomy
- Soil Fertility
- Soil Microbiology
- Saline and Sodic Soils
- Statistics

Courses to be taken

- Geographic Infosystems (GIS)

Experience

Research Assistant

Brigham Young University, September 2004 to Present

- Supervised and trained 20+ students in soil laboratory analyses
- Collected 700+ soils from Mexico, Guatemala, and the US, analyzed 1,000+ soil samples, and compiled and wrote results for professors at several
- Trained on the ICP, Atomic Absorption, Elemental Analyzer, Mass spectrometer, Gas Chromatograph
- Initiated 2 long term research projects;
  - A study of denitrifiers in hypersaline environments from the sediments of the Great Salt Lake (future publications, date pending)
  - The soil resources of the ancient Maya city of Chunchucmil, Mexico (future publications, date pending)
- Presented research at 3 national conferences and 1 regional conference
- Served as a teacher's assistant for 2 classes
- Authored 2 grant proposals and co-authored 2 others (3 of 4 funded)
- Assisted Maya archaeologists and geomorphologists in studies in the Yucatan, Mexico

Market Research Intern

InstallShield/Macrovision Shamburg, IL, Nov-Dec 2003, June – September 2006

- Performed and analyzed market research for a computer software company

Landscape Intern
Valley Crest, Palentine, IL, Summer 2004
- Supervised work crews
- Operated heavy machinery
- Completed estimation costs for landscape maintenance

Area Director
Boy Scouts of America, Pearson, WI, Summer 1997-2001
- Instructed 1000+ youth in environmental science related subjects
- Organized numerous activities and environmental service projects
- Supervised 60+ staff members

Missionary for The Church of Jesus Christ of Latter-day Saints
Montreal, Quebec, Spanish Speaking, 2002-2003

Other Skills
- **Software-** SURFER, GPS, Word, Excel, PowerPoint

Awards Received
- Speaker at 2006 college convocation
- Dean's Award from Brigham Young University for humanitarian service, 2002
- Eagle, BSA, 1997
- Employee of the Year, Camp Ma-ka-ja-wan, 1999

LAB – SUPV – as reference

Appendix A

Soil Profile Descriptions

Only portions of the original report which included surveys for multiple degas sites has been submitted, therefore pagination may not be sequential.

Site G-22 **SP10**

Name	Ryan Sweetwood	**Drainage**	WD — Well Drained
Date	11/14/2007	**Flooding**	none
Weather	60°F	**Ponding**	none
Location	N 39.69014°, W 110.49581°	**Depth to Water Table**	Unknown
Datum	NAD 83	**Earth Cover**	Douglas fir, grasses and mountain mahogany
		Parent Material	COL, ALL — colluvium, alluvium
Slope Aspect	ESE	**Bedrock, Kind**	SST, SIS, SHA — Interbedded sandstone, siltstone and shale
Slope Gradient	35%	**Bedrock, Fracture**	-
Slope Complexity	complex	**Bedrock, Hardness**	MO — moderate
Slope Shape	VV convex, convex	**Bedrock, Depth**	~95 — estimated
Hillslope Profile Position	BS backslope	**Erosion, Kind**	G — gully
Geomorphic Component	CT center third	**Erosion, Degree**	2 — 25 up to 75%
Microrelief	MH micrihigh	**Runoff**	VH — Very high
Drainage Pattern	Dendritic	**Surface Fragments**	3 — extremely stony, 3 to <15%

Diagnostic Horizons	Observation Method	Depth (cm) From	Depth (cm) To	Boundary Distinctness	Boundary Topography	Color Moist	Dry	Texture	Structure	Reaction (HCl)	% Rock Fragments & Size	% Roots, Size & Location
A	SP	0	22	Clear	Wavy	10YR 4/2	10YR 5/2	l	1,ABK, F	VE	10%, GR	10%, VF to F
Bt1	SP	22	33	Abrupt	Wavy	10YR 4/2	10YR 5/1	sicl	3,GRV C	VE	<5%, GR	5%, VF to F
Bt2	SP	33	41	Abrupt	Wavy	10YR 4/3	10YR 6/3	nd	2,GRV C	VE	15%, GR	5%, VF to M
Bt3	SP	41	67+	Abrupt	Wavy	10YR 4/1	10YR 6/1	cl	3,GRV C	ST	5%, GR	<5%, VF to F

*Became difficult to penetrate with shovel

Site G-22 road **SP11**

Name	Ryan Sweetwood					**Drainage**	WD	Well Drained				
Date	11/14/2007					**Flooding**	none					
Weather	60°f					**Ponding**	none					
Location	N 39.68993°, W 110.49628°					**Depth to Water Table**	Unknown					
Datum	NAD 83					**Earth Cover**		mountain mahogany w/ some Douglas fir and pina pine				
						Parent Material	COL	colluvium				
Slope Aspect	E					**Bedrock, Kind**	SST, SIS, SHA	Interbedded sandstone, siltstone and shale				
Slope Gradient	40%					**Bedrock, Fracture**	-					
Slope Complexity	complex					**Bedrock, Hardness**	MO	moderate				
Slope Shape	LL linear, linear					**Bedrock, Depth**	41 cm					
Hillslope Profile Position	BS backslope					**Erosion, Kind**	G	gully				
Geomorphic Component	CT center third					**Erosion, Degree**	2	25 up to 75%				
Microrelief	MH microhigh					**Runoff**	H	high				
Drainage Pattern	Dendritic					**Surface Fragments**	3	extremely stony, 3 to <15%				

Diagnostic Horizons	**Observation Method**	**Depth (cm)**		**Boundary**		**Color Moist**	**Dry**	**Texture**	**Structure**	**Reaction (HCl)**	**% Rock Fragments & Size**	**% Roots, Size & Location**
		From	To	Distinct-ness	Topo-graphy							
A	SP	0	8	Gradual	Wavy	10YR 4/2	10YR 5/2	I	1,ABK, F	VE	10%, GR	10%, VF to F
B	SP	8	41	Gradual	Wavy	10YR 4/2	10YR 5/2	I	1,ABK, F	VE	15%, GR	10%, VF to M

Site G-22 road **SP12**

Name	Ryan Sweetwood					**Drainage**	WD	Well Drained				
Date	11/14/2007					**Flooding**	none					
Weather	60°F					**Ponding**	none					
Location	N 39.68910°, W 110.49728°					**Depth to Water Table**	Unknown					
Datum	NAD 83					**Earth Cover**		mountain mahogany and sagebrush w/ some juniper				
						Parent Material	COL	colluvium				
Slope Aspect	E					**Bedrock, Kind**	SST, SIS, SHA	Interbedded sandstone, siltstone and shale				
Slope Gradient	15%					**Bedrock, Fracture**	-					
Slope Complexity	complex					**Bedrock, Hardness**	MO	moderate				
Slope Shape	LC linear, concave					**Bedrock, Depth**	~85 cm	estimated				
Hillslope Profile Position	SH shoulder					**Erosion, Kind**	G	gully				
Geomorphic Component	MT mountain top					**Erosion, Degree**	2	25 up to 75%				
Microrelief	ML microlow					**Runoff**	M	medium				
Drainage Pattern	Dendritic					**Surface Fragments**	2	very stony, 0.1 to <3%				
Diagnostic Horizons	**Observation Method**	**Depth (cm)**		**Boundary**		**Color Moist**	**Dry**	**Texture**	**Structure**	**Reaction (HCl)**	**% Rock Fragments & Size**	**% Roots, Size & Location**
		From	To	Distinctness	Topography							
A	SP	0	13	Gradual	Wavy	10YR 3/2	10YR 4/2	cl	1,ABK, M	ST	5%, GR	10%, VF to M
B1	SP	13	38	Gradual	Wavy	10YR 5/3	10YR 6/3	sicl	2,ABK, VC	VE	0%	5%, VF to C
B2	SP	38	62+	Gradual	Wavy	10YR 5/3	10YR 6/3	nd	2,ABK, VC	VE	0%	<5%, VF to M

*Became difficult to penetrate with shovel

B1 and B2 submitted as one sample for analysis

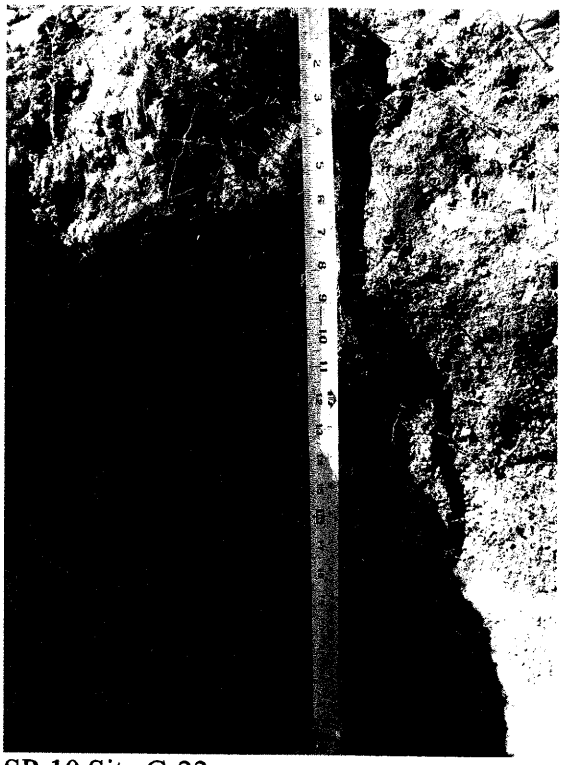
Site G-22 road **SP13**

Name	Ryan Sweetwood	**Drainage**	WD — Well Drained
Date	11/14/2007	**Flooding**	none
Weather	60°F	**Ponding**	none
Location	N 39.68814°, W 110.49792°	**Depth to Water Table**	Unknown
Datum	NAD 83	**Earth Cover**	sagebrush w/ some juniper, Douglas fir, and mountain mahogany
		Parent Material	COL — colluvium
Slope Aspect	SE	**Bedrock, Kind**	SST, SIS, SHA — Interbedded sandstone, siltstone and shale
Slope Gradient	6%	**Bedrock, Fracture**	-
Slope Complexity	complex	**Bedrock, Hardness**	MO — moderate
Slope Shape	VL convex, linear	**Bedrock, Depth**	31 cm
Hillslope Profile Position	SU summit	**Erosion, Kind**	G — gully
Geomorphic Component	MT mountain top	**Erosion, Degree**	3 — 75 up to 100%
Microrelief	ML microlow	**Runoff**	M — medium
Drainage Pattern	Dendritic	**Surface Fragments**	3 — extremely stony, 3 to <15%

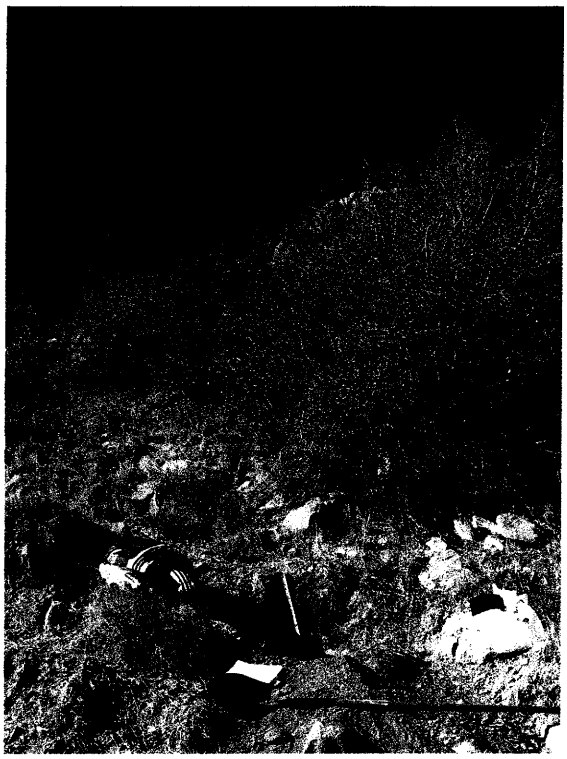
Diagnostic Horizons	**Observation Method**	**Depth (cm)**		**Boundary**		**Color Moist**	**Dry**	**Texture**	**Structure**	**Reaction (HCl)**	**% Rock Fragment & Size**	**% Roots, Size & Location**
		From	To	Distinctness	Topography							
A	SP	0	14	Gradual	Wavy	10YR 3/2	10YR 4/2	l	0,SGR	VE	15%, GR	15%,VF to M
Bt	SP	14	31	Gradual	Wavy	10YR 3/2	10YR 4/3	cl	1,ABK,F	VE	15%, GR	10%, VF to M

Appendix B

Photographs



SP-10 Site G-22



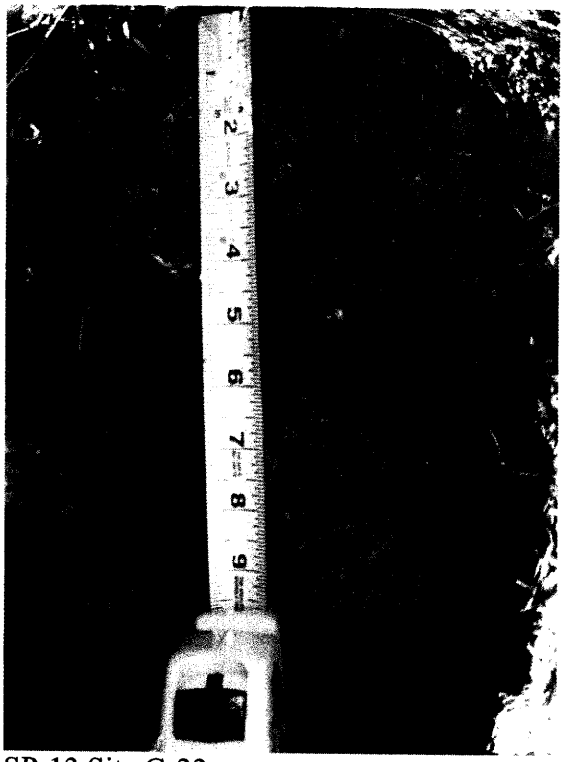
SP-10 Site G-22

SP-11 Site G-22

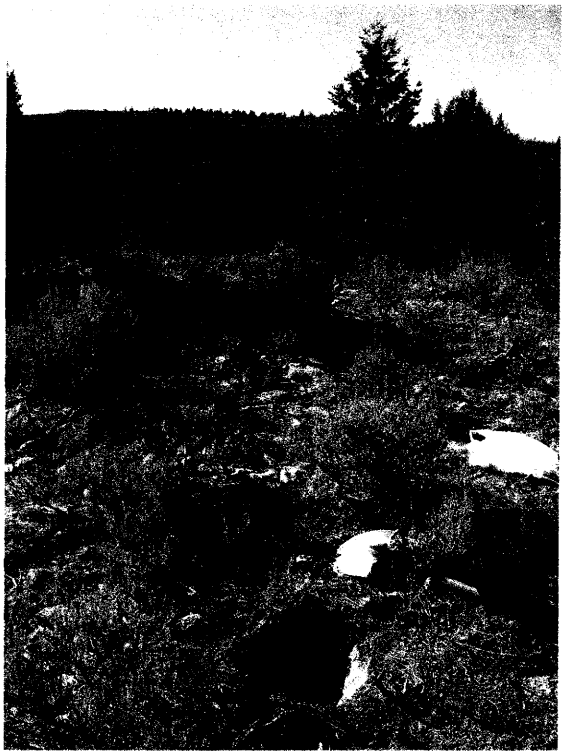
SP-11 Site G-22

SP-12 Site G-22

SP-12 Site G-22



SP-13 Site G-22

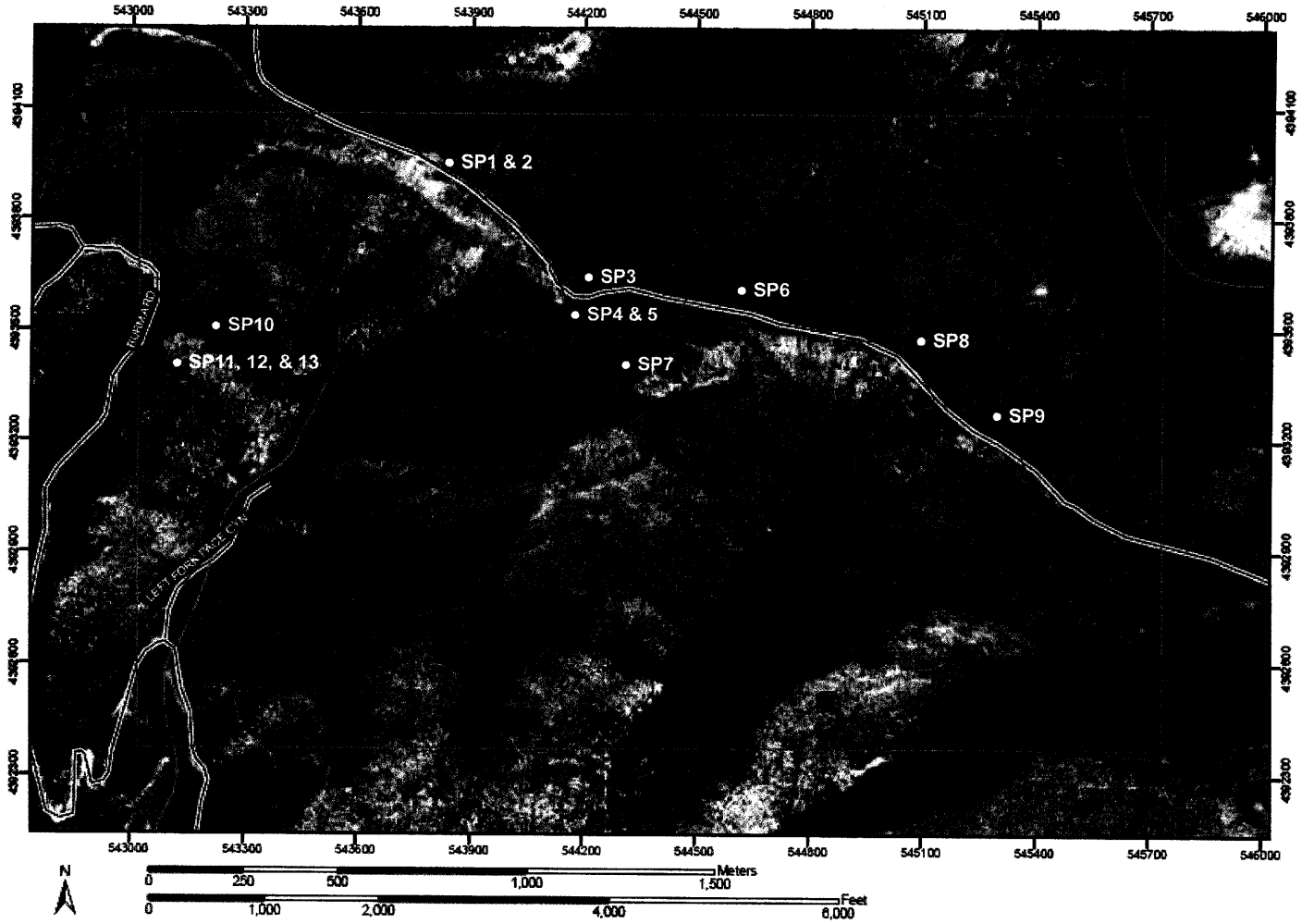


SP-13 Site G-22

Appendix C

NRCS Maps and Soil Series Description

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
- 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

Municipalities
- Cities
- Urban Areas

Water Features
- Oceans
- Streams and Canals

Transportation
- Rails

Roads
- Interstate Highways
- US Routes
- State Highways
- Local Roads
- Other Roads

MAP INFORMATION

Original soil survey map sheets were prepared at publication scale. Viewing scale and printing scale, however, may vary from the original. Please rely on the bar scale on each map sheet for proper map measurements.

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

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

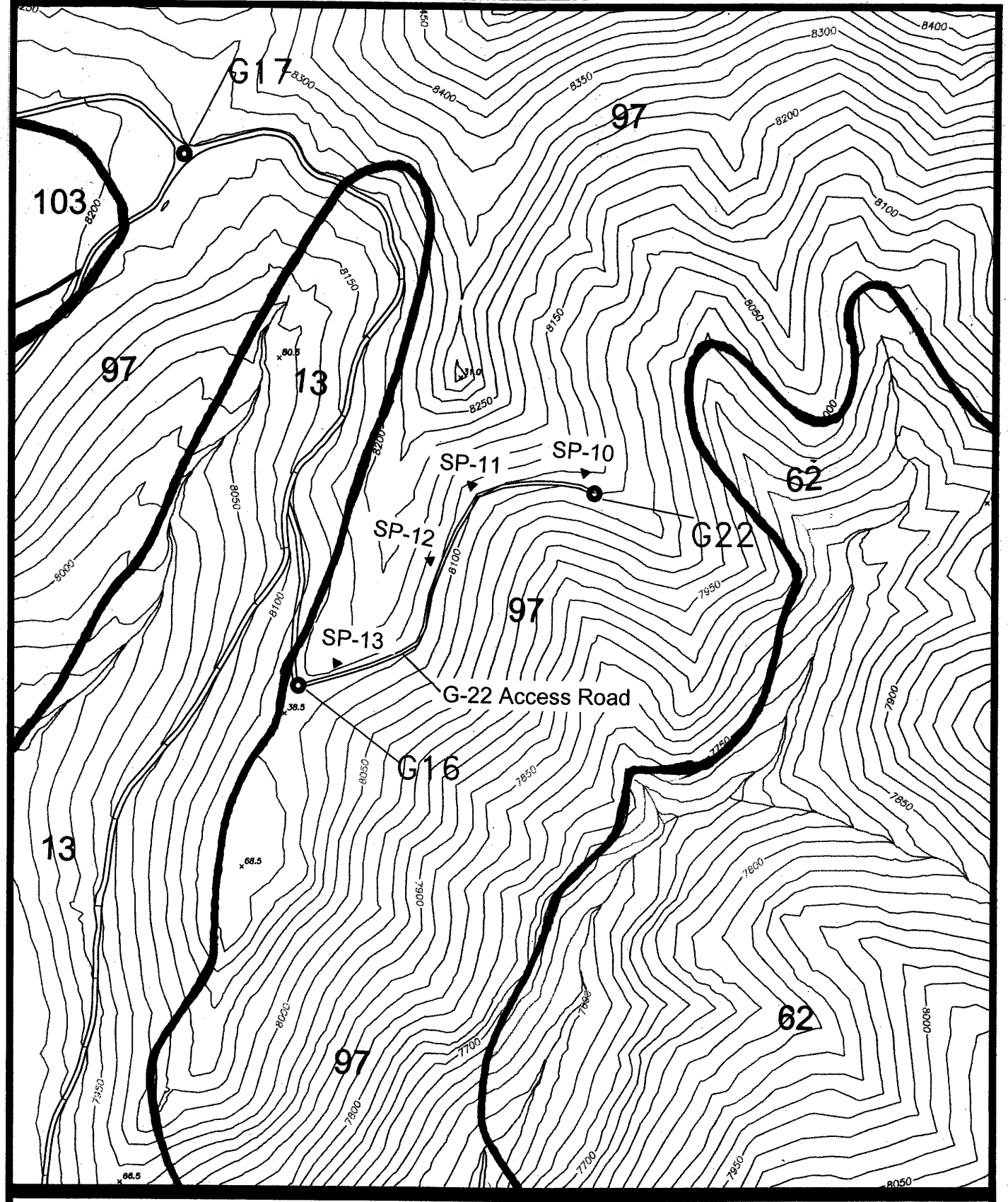
Soil Survey Area: Carbon Area, Utah, Parts of Carbon and Emery Counties
Survey Area Data: Version 3, Dec 14, 2006

Date(s) aerial images were photographed: 10/8/1998; 11/2/1998

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

Carbon Area, Utah, Parts of Carbon and Emery Counties (UT616)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
7	Beje-Trag complex	17.6	1.5%
13	Cabba family-Guben-Rock outcrop complex	3.4	0.3%
26	Doney family, 50 to 70 percent slopes	0.1	0.0%
62	Midfork family-Comodore complex	240.7	21.0%
97	Rottulee family-Trag complex	525.6	45.8%
100	Senchert loam, 3 to 15 percent slopes	235.7	20.5%
101	Senchert loam, 30 to 50 percent slopes	125.7	10.9%
Totals for Area of Interest (AOI)		1,148.8	100.0%



Legend

═══	Road
G 16	Degas Well Location
▲	Soil Test Pit Location
97 ━━	Soil Map Unit

Scale: 1" = 850' (approximate)

SOIL MAP G-22 PAD AND ACCESS ROAD

Established Series
Rev. JCM/CAM/JEB
02/1999 6-22

ROTTULEE SERIES[1]

The soils of the Rottulee series are well-drained, moderately deep soils over shattered limestone. They are on shale and limestone bedrock uplands. The mean annual precipitation is about 18 inches and the mean annual air temperature is about 42 degrees F.

TAXONOMIC CLASS: Fine-loamy, mixed, superactive, frigid Entic Haplustolls

TYPICAL PEDON: Rottulee silt loam, grassland. (Colors are for dry soil unless otherwise noted.)

A1--0 to 2 inches; dark-brown (7.5YR 4/2) silt loam, dark brown (7.5YR 3.2) when moist; weak, thin, platy structure; slightly hard, very friable, slightly sticky and slightly plastic; many very fine roots and tubular pores; moderately calcareous; clear, smooth boundary. (2 to 5 inches thick)

B1--2 to 6 inches; reddish-brown (5YR 5/3) silt loam, dark reddish brown (5YR 3/3) when moist; weak, medium, prismatic structure; slightly hard, very friable, slightly sticky and plastic; common very fine roots; common fine and very fine tubular pores; moderately calcareous; clear, wavy boundary. (2 to 6 inches thick)

B2--6 to 10 inches; light reddish-brown (5YR 6/3) heavy silt loam, reddish brown (5YR 4/4) when moist; moderate, medium, prismatic structure; hard, friable, sticky and plastic; common very fine roots; common fine and very fine tubular pores; moderately calcareous; clear, wavy boundary. (3 to 7 inches thick)

B3--10 to 15 inches; light reddish-brown (5YR 6/3) heavy silt loam, reddish brown (5YR 4/4) when moist; moderate, medium and fine, blocky structure; hard, friable, sticky and plastic; common very fine roots and tubular pores; strongly calcareous with a few threads of segregated lime; clear, wavy boundary. (4 to 8 inches thick)

Cca--15 to 22 inches; light reddish-brown (5YR 6/4) gravelly light clay loam, yellowish red (5YR 5/6) when moist; weak, fine, blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine roots and tubular pores; 20 percent (volume) shale fragments; strongly calcareous; common fine threads of segregated lime; gradual boundary.

R--22 inches, shattered limestone.

TYPE LOCATION: Big Horn County, Montana; 660 feet north and 220 feet east of the SW corner of sec. 18, T.8S., R.33E.

RANGE IN CHARACTERISTICS: The control section is silt loam, loam, light silty clay loam, or light clay loam with 20 to 34 percent clay and 15 to 25 percent fine or medium sand and with gravel-size shale fragments increasing to as much as 30 percent just above the bedrock. The soil is weakly to strongly calcareous with increasing quantity of lime with increased depth above the bedrock. The soil has hue of 7.5YR through 10R. Mean annual soil temperature ranges from 44 to 47 degrees F., and average summer soil temperature ranges from 59 to 65 degrees F.

The Cca horizon has few to common films and threads of lime or few masses of accumulated flour lime. It contains 8 to 15 percent (estimated) CaC03 equivalent.

COMPETING SERIES: These are the Amor, Bynum, Darret, Duffy, Max, Peritsa, Prospect, Quigley, Searing, Shambo and Twin Creek series. Amor and Peritsa soils have a paralithic contact at depths of 20 to 40 inches. Bynum soils have average summer soil temperature of 52 to 58 degrees F. and have hue of 10YR or 2.5Y. Darret soils have an argillic horizon. Duffy, Max, Prospect and Quigley soils have hue of 10YR through 5Y. Max, Prospect, Quigley, Shambo and Twin Creek soils lack bedrock within depth of 40 inches. Searing soils are noncalcareous to depths of 10 to 24 inches.

GEOGRAPHIC SETTING: Rottulee soils are on gently to strongly rolling red shale and limestone bedrock uplands at elevations of 4,500 to 5,500 feet. The climate is dry-subhumid with mean annual precipitation of 17 to 19 inches, 80 percent of which falls in April through October. The annual temperature ranges from 40 to 45 degrees F. and the mean summer temperature ranges from 55 to 65 degrees F. The frost-free season ranges from 90 to 110 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Abac soils and the competing Peritsa and Twin Creek soils. Abac soils have sandstone at depths shallower than 20 inches.

DRAINAGE AND PERMEABILITY: Well-drained; medium runoff; moderate permeability.

USE AND VEGETATION: Native range use. Native vegetation is phlox, green needlegrass, prairie junegrass, gayfeather, and bluebunch wheatgrass.

DISTRIBUTION AND EXTENT: South-central Montana. The Rottulee series is inextensive.

MLRA OFFICE RESPONSIBLE: Lakewood, Colorado

SERIES ESTABLISHED: Big Horn County (Big Horn Area), Montana, 1970.

REMARKS: The Rottulee soils were formerly classified as Chestnut soils.

OSED scanned by SSQA. Last revised by state on 8/74.

National Cooperative Soil Survey
U.S.A.

[1]http://www2.ftw.nrcs.usda.gov/osd/dat/R/ROTTULEE.html

LOCATION STUBBS WY
Established Series
Rev. PSD-RJE-JAL
08/2002 6-22

STUBBS SERIES[1]

The Stubbs series consists of moderately deep, well drained soils that formed in material weathered in place from soft, calcareous shale interbedded with siltstone. Stubbs soils are on mountain sides and have slopes of 2 to 25 percent. The mean annual precipitation is about 20 inches, and the mean annual temperature is about 38 degrees F.

TAXONOMIC CLASS: Fine-loamy, mixed, superactive Pachic Argicryolls

TYPICAL PEDON: Stubbs loam-rangeland. (Colors are for dry soil unless otherwise stated.)

A--0 to 6 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; strong fine granular structure; soft, very friable, moderately sticky and slightly plastic; neutral (pH 6.8); clear smooth boundary. (4 to 8 inches thick)

AB--6 to 16 inches; dark gray (10YR 4/1) loam, black (10YR 2/1) moist; weak medium prismatic structure parting to moderate medium subangular blocky; slightly hard, very friable, moderately sticky and moderately plastic; neutral (pH 7.2); clear smooth boundary. (8 to 12 inches thick)

Bt1--16 to 20 inches; grayish brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate fine prismatic structure parting to moderate fine subangular blocky; very hard, very friable, moderately sticky and moderately plastic; continuous faint clay films on faces of peds and in root channels; neutral (pH 7.2); gradual wavy boundary.

Bt2--20 to 30 inches; brown (10YR 5/3) clay loam, brown (10YR 4/3) moist; moderate fine prismatic structure parting to moderate fine subangular blocky; very hard, very friable, moderately sticky and moderately plastic; continuous faint clay films on faces of peds and in root channels; slightly alkaline (pH 7.4); gradual wavy boundary. (Combined thickness of the Bt horizon is 8 to 24 inches)

Btk--30 to 34 inches; light yellowish brown (2.5Y 6/3) clay loam, light olive brown (2.5Y 5/3) moist; weak medium subangular blocky structure; hard, very friable, moderately sticky and moderately plastic; common faint clay films on faces of peds and in root channels; strongly effervescent, lime in common soft masses; moderately alkaline (pH 8.4); gradual wavy boundary. (0 to 19 inches thick)

Cr--34 to 60 inches; weakly calcareous, soft shale and siltstone.

TYPE LOCATION: Johnson County, Wyoming; NW1/4, NW1/4, sec. 34, T. 45 N., R. 84 W.

RANGE IN CHARACTERISTICS: The mollic epipedon is 16 to 32 inches thick. Depth to calcareous material is 15 to 36 inches. The solum is 20 to 40 inches thick and usually rests on the paralithic contact. Some pedons have a thin C horizon. Depth to the paralithic contact is 20 to 40 inches. The mean annual soil temperature is 38 to 43 degrees F. Small, flat rock fragments range from 0 to 15 percent.

The A horizon has hue of 2.5Y or 10YR, value of 4 or 5 dry and 2 or 3 moist, and chroma of 1 or 2. It has granular or subangular blocky structure. This horizon is neutral or slightly alkaline.

The Bt horizon has hue of 2.5Y through 7.5YR, value of 5 or 6 dry and 3 or 4 moist, and chroma of 2 through 4. It is loam or clay loam which averages 28 to 35 percent clay. This horizon has prismatic or subangular blocky structure. It is neutral or slightly alkaline.

COMPETING SERIES: These are the Bachus, Bavdark, Benteen, Clayburn, Croydon, Crystalbutte, Davtone, Decross, Dehana, Demast, Dranburn, Dranyon, Dry Canyon, Echemoor, Hagenbarth, Millerlake, Pontuge, Senchert, Southmount, Squawval, Thulepah, Vadnais, and Winu series. Bavdark, Croydon, Crystalbutte, Decross, Dehana, Dranburn, Dry Canyon, Pontuge, Millerlake, Southmount, and Thulepah soils are more than 40 inches deep. Bachus, Benteen, Senchert, Winu, and Vadnais soils have a lithic contact at depths of less than 40 inches. Clayburn, Demast, Dranyon, and Hagenbarth soils are noncalcareous throughout. Davtone soils have hue of 5YR or 2.5YR in the Bt horizon. Squawval soils are not effervescent in any part and have paralithic materials consisting of weathered quartz monzonite in the lower part of the series control section.

GEOGRAPHIC SETTING: Stubbs soils are on mountain sides. Slopes are 2 to 25 percent. These soils formed in moderately fine textured sediments weathered residually from underlying calcareous, soft shale and siltstone. Elevation is 8,000 to 9,000 feet. The mean annual precipitation is about 18 to 24 inches, and the mean annual temperature is 35 to 41 degrees F. The frost-free season is less than 80 days.

GEOGRAPHICALLY ASSOCIATED SOILS: These are the Jenkinson and Turk soils. Jenkinson soils lack an epipedon and have very fine textured argillic horizons.

DRAINAGE AND PERMEABILITY: Well drained; medium runoff; moderate permeability.

USE AND VEGETATION: These soils are used for range, recreation, and wildlife

habitat. Native vegetation is big sagebrush, Idaho fescue, Columbia needlegrass, King fescue, silvery lupine, and thickspike wheatgrass.

DISTRIBUTION AND EXTENT: Big Horn Mountains of north-central Wyoming. The series is of moderate extent.

MLRA OFFICE RESPONSIBLE: Bozeman, Montana

SERIES ESTABLISHED: Johnson County (Southern Part Area), Wyoming; 1971.

National Cooperative Soil Survey
U.S.A.

[1]**http://www2.ftw.nrcs.usda.gov/osd/dat/S/STUBBS.html**

Appendix D

Laboratory Analyses

Inter-Mountain Laboratories, Inc.
1673 Terra Avenue, Sheridan, Wyoming 82801
(307) 672-8945

Soil Analysis Report
Canyon Fuel Company
Dugout Canyon Mine
P.O. Box 1029
Wellington, UT 84542

Report ID: S0711436001

Project: Dugout Canyon Mine
Date Received: 11/26/2007

Date Reported: 1/14/2008
Work Order: S0711436

Lab ID	Sample ID	Depths cm	Calcium meq/L	Magnesium meq/L	Sodium meq/L	Potassium meq/L	SAR
S0711436-001	SP-1 A	2-10	6.46	1.46	0.41	1.07	0.20
S0711436-002	SP-1 AB	10-33	3.72	1.05	0.46	0.32	0.30
S0711436-003	SP-1 B	33-61	2.48	0.76	0.29	0.18	0.23
S0711436-004	SP-2 A	0-15	3.00	0.76	0.47	0.12	0.34
S0711436-005	SP-2 BC	15-46	2.31	0.59	0.34	0.02	0.28
S0711436-006	SP-3 OA	0-9	3.29	1.10	0.24	0.74	0.16
S0711436-007	SP-3 BC	9-33	2.79	2.63	20.9	0.33	12.7
S0711436-008	SP-4 A	0-15	2.92	1.01	0.55	0.44	0.39
S0711436-009	SP-4 B	15-26	3.06	0.97	0.22	0.08	0.15
S0711436-010	SP-5 A	5-15	2.46	0.85	0.39	0.46	0.30
S0711436-011	SP-5 B	15-36	1.15	0.28	0.15	0.22	0.18
S0711436-012	SP-6 A	5-38	2.15	0.50	0.16	0.27	0.14
S0711436-013	SP-6 B	38-69	1.10	0.38	0.15	0.27	0.18
S0711436-014	SP-7 A	3-15	0.78	0.38	0.38	0.22	0.51
S0711436-015	SP-7 B	15-51	1.91	0.53	0.22	0.13	0.20
S0711436-016	SP-8 A	0-13	1.47	0.48	0.24	0.34	0.24
S0711436-017	SP-8 B	13-45	0.87	0.28	0.16	0.13	0.21
S0711436-018	SP-9 A	3-18	2.63	0.69	0.14	0.75	0.11
S0711436-019	SP-9 B	18-41	2.12	0.66	0.14	0.49	0.12
S0711436-020	SP-10 A	0-22	3.94	0.82	0.21	0.21	0.13

These results apply only to the samples tested.

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

Reviewed by: Karen A Secor
Karen Secor, Soil Lab Supervisor

Inter-Mountain Laboratories, Inc.
1673 Terra Avenue, Sheridan, Wyoming 82801
(307) 672-8945

Soil Analysis Report
Canyon Fuel Company
Dugout Canyon Mine
P.O. Box 1029
Wellington, UT 84542

Report ID: S0711436001

Project: Dugout Canyon Mine
Date Received: 11/26/2007

Date Reported: 1/14/2008
Work Order: S0711436

Lab ID	Sample ID	Depths cm	Calcium meq/L	Magnesium meq/L	Sodium meq/L	Potassium meq/L	SAR
S0711436-021	SP-10 B1	22-33	3.35	0.76	0.19	0.05	0.13
S0711436-022	SP-10 B2	33-41	3.99	1.18	2.27	0.05	1.41
S0711436-023	SP-10 B3	41-67	2.50	0.60	0.26	0.03	0.21
S0711436-024	SP-11 A	0-8	4.10	1.64	0.12	0.60	0.07
S0711436-025	SP-11 BC	8-41	3.35	1.29	0.15	0.64	0.10
S0711436-026	SP-12 A	0-13	4.37	0.77	0.11	0.44	0.07
S0711436-027	SP-12 B	13-38	6.74	1.34	0.13	0.19	0.06
S0711436-028	SP-13 A	0-14	6.31	0.83	0.38	0.34	0.20
S0711436-029	SP-13 BC	14-31	6.63	0.82	0.28	0.29	0.14

These results apply only to the samples tested.

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

Reviewed by: Karen A Secor
Karen Secor, Soil Lab Supervisor

Inter-Mountain Laboratories, Inc.
1673 Terra Avenue, Sheridan, Wyoming 82801
(307) 672-8945

Soil Analysis Report

Canyon Fuel Company

Dugout Canyon Mine
P.O. Box 1029
Wellington, UT 84542

Report ID: S0711436001

Project: Dugout Canyon Mine
Date Received: 11/26/2007

Date Reported: 1/14/2008
Work Order: S0711436

Lab ID	Sample ID	Depths cm	Sand %	Silt %	Clay %	Texture	Coarse Fragment %
S0711436-001	SP-1 A	2-10	43.0	39.0	18.0	Loam	6.26
S0711436-002	SP-1 AB	10-33	28.0	45.0	27.0	Clay Loam	0.64
S0711436-003	SP-1 B	33-61	33.0	34.0	33.0	Clay Loam	0.14
S0711436-004	SP-2 A	0-15	46.0	22.0	32.0	Sandy Clay Loam	14.9
S0711436-005	SP-2 BC	15-46	42.0	30.0	28.0	Clay Loam	9.52
S0711436-006	SP-3 OA	0-9	61.0	30.0	9.0	Sandy Loam	19.8
S0711436-007	SP-3 BC	9-33	53.0	29.0	18.0	Sandy Loam	6.48
S0711436-008	SP-4 A	0-15	50.0	30.0	20.0	Loam	7.34
S0711436-009	SP-4 B	15-26	42.0	39.0	19.0	Loam	11.4
S0711436-010	SP-5 A	5-15	52.0	34.0	14.0	Sandy Loam	3.64
S0711436-011	SP-5 B	15-36	56.0	29.0	15.0	Sandy Loam	12.0
S0711436-012	SP-6 A	5-38	40.0	46.0	14.0	Loam	8.12
S0711436-013	SP-6 B	38-69	42.0	42.0	16.0	Loam	16.5
S0711436-014	SP-7 A	3-15	51.0	37.0	12.0	Loam	7.76
S0711436-015	SP-7 B	15-51	59.0	31.0	10.0	Sandy Loam	9.46
S0711436-016	SP-8 A	0-13	69.0	22.0	9.0	Sandy Loam	1.59
S0711436-017	SP-8 B	13-45	71.0	20.0	9.0	Sandy Loam	0.28
S0711436-018	SP-9 A	3-18	46.0	32.0	22.0	Loam	0.24
S0711436-019	SP-9 B	18-41	40.0	33.0	27.0	Clay Loam	10.7
S0711436-020	SP-10 A	0-22	34.0	41.0	25.0	Loam	31.9

These results apply only to the samples tested.

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

Reviewed by: Karen A Secor
Karen Secor, Soil Lab Supervisor

Inter-Mountain Laboratories, Inc.
1673 Terra Avenue, Sheridan, Wyoming 82801
(307) 672-8945

Soil Analysis Report

Canyon Fuel Company
Dugout Canyon Mine
P.O. Box 1029
Wellington, UT 84542

Report ID: S0711436001

Project: Dugout Canyon Mine
Date Received: 11/26/2007

Date Reported: 1/14/2008
Work Order: S0711436

Lab ID	Sample ID	Depths cm	Sand %	Silt %	Clay %	Texture	Coarse Fragment %
S0711436-021	SP-10 B1	22-33	8.0	54.0	38.0	Silty Clay Loam	55.3
S0711436-022	SP-10 B2	33-41					55.2
S0711436-023	SP-10 B3	41-67	29.0	39.0	32.0	Clay Loam	43.9
S0711436-024	SP-11 A	0-8	35.0	45.0	20.0	Loam	16.5
S0711436-025	SP-11 BC	8-41	30.0	48.0	22.0	Loam	16.7
S0711436-026	SP-12 A	0-13	31.0	41.0	28.0	Clay Loam	28.7
S0711436-027	SP-12 B	13-38	7.0	65.0	28.0	Silty Clay Loam	27.7
S0711436-028	SP-13 A	0-14	46.0	34.0	20.0	Loam	17.1
S0711436-029	SP-13 BC	14-31	41.0	28.0	31.0	Clay Loam	1.51

These results apply only to the samples tested.

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Lab ID	Sample ID	Depths	TKN	Nitrogen Nitrate	Phosphorus	Boron	Selenium
		cm	%	ppm	ppm	ppm	ppm
S0711436-001	SP-1 A	2-10	0.17	0.26	14.5	0.23	<0.02
S0711436-002	SP-1 AB	10-33	0.09	0.71	5.04	0.15	<0.02
S0711436-003	SP-1 B	33-61	0.17	0.48	5.33	0.36	<0.02
S0711436-004	SP-2 A	0-15	0.12	<0.02	8.10	0.29	<0.02
S0711436-005	SP-2 BC	15-46	0.06	<0.02	4.15	0.26	<0.02
S0711436-006	SP-3 OA	0-9	0.77	<0.02	55.0	0.96	<0.02
S0711436-007	SP-3 BC	9-33	0.08	0.10	12.9	0.28	<0.02
S0711436-008	SP-4 A	0-15	0.07	2.76	14.5	0.32	<0.02
S0711436-009	SP-4 B	15-26	0.12	1.59	7.70	0.37	<0.02
S0711436-010	SP-5 A	5-15	0.37	<0.02	57.8	0.64	<0.02
S0711436-011	SP-5 B	15-36	0.07	0.12	21.3	0.21	<0.02
S0711436-012	SP-6 A	5-38	0.17	<0.02	51.6	0.27	<0.02
S0711436-013	SP-6 B	38-69	0.25	0.41	16.8	0.14	<0.02
S0711436-014	SP-7 A	3-15	0.27	12.1	57.5	0.28	<0.02
S0711436-015	SP-7 B	15-51	0.03	2.06	22.8	0.22	<0.02
S0711436-016	SP-8 A	0-13	0.32	3.96	29.7	0.35	<0.02
S0711436-017	SP-8 B	13-45	0.05	1.12	16.5	0.14	<0.02
S0711436-018	SP-9 A	3-18	0.66	15.2	21.6	0.67	<0.02
S0711436-019	SP-9 B	18-41	0.09	1.37	8.02	0.27	<0.02
S0711436-020	SP-10 A	0-22	0.13	2.09	4.74	0.21	<0.02

These results apply only to the samples tested.

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Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

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Karen Secor, Soil Lab Supervisor

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Report ID: S0711436001

Project: Dugout Canyon Mine
Date Received: 11/26/2007

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Lab ID	Sample ID	Depths	TKN	Nitrogen Nitrate	Phosphorus	Boron	Selenium
		cm	%	ppm	ppm	ppm	ppm
S0711436-021	SP-10 B1	22-33	0.08	<0.02	3.12	0.28	<0.02
S0711436-022	SP-10 B2	33-41	0.07	0.06	3.65	0.26	<0.02
S0711436-023	SP-10 B3	41-67	0.06	<0.02	2.95	0.20	<0.02
S0711436-024	SP-11 A	0-8	0.15	3.36	5.84	0.49	<0.02
S0711436-025	SP-11 BC	8-41	0.10	4.37	6.26	0.39	<0.02
S0711436-026	SP-12 A	0-13	0.27	2.68	48.7	0.59	<0.02
S0711436-027	SP-12 B	13-38	0.11	<0.02	8.40	0.40	<0.02
S0711436-028	SP-13 A	0-14	0.27	0.57	17.6	0.29	<0.02
S0711436-029	SP-13 BC	14-31	0.28	<0.02	14.7	0.34	<0.02

These results apply only to the samples tested.

Abbreviations for extractants: PE= Saturated Paste Extract, H20Sol= water soluble,AB-DTPA= Ammonium Bicarbonate-DTPA, AAO= Acid Ammonium Oxalate
Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential
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Lab ID	Sample ID	Depths cm	Total Sulfur %	T.S. AB t/1000t	Neut. Pot. t/1000t	T.S. ABP t/1000t	Total Carbon %	TOC %
S0711436-001	SP-1 A	2-10	0.03	0.97	104	103	2.6	1.4
S0711436-002	SP-1 AB	10-33	0.01	0.41	154	154	2.3	0.5
S0711436-003	SP-1 B	33-61	0.02	0.63	18.5	17.9	1.3	1.1
S0711436-004	SP-2 A	0-15	0.01	0.45	14.0	13.6	1.1	0.9
S0711436-005	SP-2 BC	15-46	<0.01	<0.01	32.7	32.7	0.7	0.3
S0711436-006	SP-3 OA	0-9	<0.01	<0.01	6.66	6.66	5.0	5.0
S0711436-007	SP-3 BC	9-33	0.01	0.44	0.77	0.33	0.6	0.6
S0711436-008	SP-4 A	0-15	<0.01	<0.01	15.7	15.7	1.1	0.9
S0711436-009	SP-4 B	15-26	<0.01	<0.01	116	116	2.4	1.0
S0711436-010	SP-5 A	5-15	<0.01	<0.01	5.68	5.68	2.8	2.7
S0711436-011	SP-5 B	15-36	<0.01	<0.01	2.13	2.13	0.7	0.6
S0711436-012	SP-6 A	5-38	0.01	0.34	3.63	3.29	2.5	2.4
S0711436-013	SP-6 B	38-69	<0.01	<0.01	2.69	2.69	0.7	0.7
S0711436-014	SP-7 A	3-15	0.03	1.08	6.60	5.52	4.0	3.9
S0711436-015	SP-7 B	15-51	<0.01	<0.01	2.53	2.53	0.6	0.6
S0711436-016	SP-8 A	0-13	0.02	0.72	3.68	2.95	3.7	3.6
S0711436-017	SP-8 B	13-45	<0.01	<0.01	1.60	1.60	0.5	0.5
S0711436-018	SP-9 A	3-18	0.03	0.96	7.23	6.27	4.0	3.9
S0711436-019	SP-9 B	18-41	<0.01	<0.01	3.34	3.34	1.1	1.0
S0711436-020	SP-10 A	0-22	<0.01	<0.01	106	106	2.1	0.8

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Lab ID	Sample ID	Depths cm	Total Sulfur %	T.S. AB t/1000t	Neut. Pot. t/1000t	T.S. ABP t/1000t	Total Carbon %	TOC %
S0711436-021	SP-10 B1	22-33	<0.01	<0.01	109	109	2.0	0.7
S0711436-022	SP-10 B2	33-41	<0.01	<0.01	310	310	2.9	<0.1
S0711436-023	SP-10 B3	41-67	0.02	0.71	185	184	0.8	<0.1
S0711436-024	SP-11 A	0-8	0.01	0.39	141	140	2.9	1.2
S0711436-025	SP-11 BC	8-41	0.02	0.49	186	185	2.6	0.4
S0711436-026	SP-12 A	0-13	0.02	0.54	58.3	57.8	4.0	3.3
S0711436-027	SP-12 B	13-38	0.02	0.75	209	209	5.2	2.7
S0711436-028	SP-13 A	0-14	<0.01	<0.01	83.4	83.4	3.0	2.0
S0711436-029	SP-13 BC	14-31	0.02	0.57	233	232	4.3	1.5

These results apply only to the samples tested.

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Abbreviations used in acid base accounting: T.S.= Total Sulfur, AB= Acid Base, ABP= Acid Base Potential, PyrS= Pyritic Sulfur, Pyr+Org= Pyritic Sulfur + Organic Sulfur, Neutral. Pot.= Neutralization Potential
Miscellaneous Abbreviations: SAR= Sodium Adsorption Ratio, CEC= Cation Exchange Capacity, ESP= Exchangeable Sodium Percentage

Reviewed by: Karen A Secor
Karen Secor, Soil Lab Supervisor

LabID	SampleID	Sampled	Begin Depth (cm)	End Depth (cm)	pH s.u.	Saturation %	Electrical Conductivity dS/m	Field Capacity %	Wilt Point %	Calcium meq/L	Magnesium meq/L
S0711436-001	SP-1 A	11/13/07	2	10	7.2	36.1	0.94	20	15	6.46	1.46
S0711436-002	SP-1 B1	11/13/07	10	33	7.4	40.6	0.53	18	14	3.72	1.05
S0711436-003	SP-1 B2	11/13/07	33	61	7.4	40.9	0.37	26	18	2.48	0.76
S0711436-004	SP-2 A	11/13/07	0	15	7.4	44.4	0.46	23	15	3.00	0.76
S0711436-005	SP-2 B	11/13/07	15	46	7.5	44.1	0.34	22	14	2.31	0.59
S0711436-006	SP-3 A	11/13/07	0	9	6.5	108	0.54	46	38	3.29	1.10
S0711436-007	SP-3 B	11/13/07	9	33	5.9	41.4	2.90	18	13	2.79	2.63
S0711436-008	SP-4 A	11/13/07	0	15	7.4	42.2	0.46	23	12	2.92	1.01
S0711436-009	SP-4 B	11/13/07	15	26	7.5	44.0	0.43	24	14	3.06	0.97
S0711436-010	SP-5 A	11/13/07	5	15	5.9	60.4	0.42	28	15	2.46	0.85
S0711436-011	SP-5 B1	11/13/07	15	36	5.5	37.0	0.19	19	10	1.15	0.28
S0711436-012	SP-6 A	11/13/07	5	38	5.8	52.5	0.31	28	15	2.15	0.50
S0711436-013	SP-6 B	11/13/07	38	69	6.3	38.5	0.20	25	10	1.10	0.38
S0711436-014	SP-7 A	11/14/07	3	15	6.4	61.8	0.15	26	18	0.78	0.38
S0711436-015	SP-7 B1	11/14/07	15	51	6.4	30.0	0.25	13	10	1.91	0.53
S0711436-016	SP-8 A	11/14/07	0	13	6.3	56.1	0.29	20	15	1.47	0.48
S0711436-017	SP-8 B1	11/14/07	13	45	6.5	31.8	0.14	11	10	0.87	0.28
S0711436-018	SP-9 A	11/14/07	3	18	6.8	68.2	0.43	29	24	2.63	0.69
S0711436-019	SP-9 B1	11/14/07	18	41	6.8	44.1	0.34	17	14	2.12	0.66
S0711436-020	SP-10 A	11/14/07	0	22	7.6	42.0	0.47	19	13	3.94	0.82
S0711436-021	SP-10 B1	11/14/07	22	33	7.6	44.0	0.44	18	16	3.35	0.76
S0711436-022	SP-10 B2	11/14/07	33	41	7.7	41.5	0.74			2.66	0.93
S0711436-023	SP-10 B3	11/14/07	41	67	7.8	37.6	0.33	18	13	2.50	0.60
S0711436-024	SP-11 A	11/14/07	0	8	8.0	51.3	0.54	19	14	4.10	1.64
S0711436-025	SP-11 B	11/14/07	8	41	7.8	38.2	0.52	18	12	3.35	1.29
S0711436-026	SP-12 A	11/14/07	0	13	7.5	60.5	0.54	28	23	4.37	0.77
S0711436-027	SP-12 B1	11/14/07	13	38	7.4	48.9	0.80	31	22	6.74	1.34
S0711436-028	SP-13 A	11/14/07	0	14	7.5	54.1	0.75	28	16	6.31	0.83
S0711436-029	SP-13 B	11/14/07	14	31	7.2	55.2	0.77	28	20	6.63	0.82

LabID	SampleID	Sampled	Sodium meq/L	Potassium meq/L	SAR	Sand %	Silt %	Clay %	Texture	Coarse Fragment %
S0711436-001	SP-1 A	11/13/07	0.41	1.07	0.20	43.0	39.0	18.0	Loam	6.26
S0711436-002	SP-1 B1	11/13/07	0.46	0.32	0.30	28.0	45.0	27.0	Clay Loam	0.64
S0711436-003	SP-1 B2	11/13/07	0.29	0.18	0.23	33.0	34.0	33.0	Clay Loam	0.14
S0711436-004	SP-2 A	11/13/07	0.47	0.12	0.34	46.0	22.0	32.0	Sandy Clay Loam	14.9
S0711436-005	SP-2 B	11/13/07	0.34	0.02	0.28	42.0	30.0	28.0	Clay Loam	9.52
S0711436-006	SP-3 A	11/13/07	0.24	0.74	0.16	61.0	30.0	9.0	Sandy Loam	19.8
S0711436-007	SP-3 B	11/13/07	20.9	0.33	12.7	53.0	29.0	18.0	Sandy Loam	6.48
S0711436-008	SP-4 A	11/13/07	0.55	0.44	0.39	50.0	30.0	20.0	Loam	7.34
S0711436-009	SP-4 B	11/13/07	0.22	0.08	0.15	42.0	39.0	19.0	Loam	11.4
S0711436-010	SP-5 A	11/13/07	0.39	0.46	0.30	52.0	34.0	14.0	Sandy Loam	3.64
S0711436-011	SP-5 B1	11/13/07	0.15	0.22	0.18	56.0	29.0	15.0	Sandy Loam	12.0
S0711436-012	SP-6 A	11/13/07	0.16	0.27	0.14	40.0	46.0	14.0	Loam	8.12
S0711436-013	SP-6 B	11/13/07	0.15	0.27	0.18	42.0	42.0	16.0	Loam	16.5
S0711436-014	SP-7 A	11/14/07	0.38	0.22	0.51	51.0	37.0	12.0	Loam	7.76
S0711436-015	SP-7 B1	11/14/07	0.22	0.13	0.20	59.0	31.0	10.0	Sandy Loam	9.46
S0711436-016	SP-8 A	11/14/07	0.24	0.34	0.24	69.0	22.0	9.0	Sandy Loam	1.59
S0711436-017	SP-8 B1	11/14/07	0.16	0.13	0.21	71.0	20.0	9.0	Sandy Loam	0.28
S0711436-018	SP-9 A	11/14/07	0.14	0.75	0.11	46.0	32.0	22.0	Loam	0.24
S0711436-019	SP-9 B1	11/14/07	0.14	0.49	0.12	40.0	33.0	27.0	Clay Loam	10.7
S0711436-020	SP-10 A	11/14/07	0.21	0.21	0.13	34.0	41.0	25.0	Loam	31.9
S0711436-021	SP-10 B1	11/14/07	0.19	0.05	0.13	8.0	54.0	38.0	Silty Clay Loam	55.3
S0711436-022	SP-10 B2	11/14/07	2.27	0.05	1.41					55.2
S0711436-023	SP-10 B3	11/14/07	0.26	0.03	0.21	29.0	39.0	32.0	Clay Loam	43.9
S0711436-024	SP-11 A	11/14/07	0.12	0.60	0.07	35.0	45.0	20.0	Loam	16.5
S0711436-025	SP-11 B	11/14/07	0.15	0.64	0.10	30.0	48.0	22.0	Loam	16.7
S0711436-026	SP-12 A	11/14/07	0.11	0.44	0.07	31.0	41.0	28.0	Clay Loam	28.7
S0711436-027	SP-12 B1	11/14/07	0.13	0.19	0.06	7.0	65.0	28.0	Silty Clay Loam	27.7
S0711436-028	SP-13 A	11/14/07	0.38	0.34	0.20	46.0	34.0	20.0	Loam	17.1
S0711436-029	SP-13 B	11/14/07	0.28	0.29	0.14	41.0	28.0	31.0	Clay Loam	1.51

LabID	SampleID	Sampled	TKN %	Nitrate ppm	Phosphorus ppm	Boron ppm	Selenium ppm	Total Sulfur %	T.S. AB t/1000t	Neut. Pot. t/1000t	T.S. ABP t/1000t	Total Carbon %	TOC %
S0711436-001	SP-1 A	11/13/07	0.17	0.26	14.5	0.23	<0.02	0.03	0.97	104	103	2.6	1.4
S0711436-002	SP-1 B1	11/13/07	0.09	0.71	5.04	0.15	<0.02	0.01	0.41	154	154	2.3	0.5
S0711436-003	SP-1 B2	11/13/07	0.17	0.48	5.33	0.36	<0.02	0.02	0.63	18.5	17.9	1.3	1.1
S0711436-004	SP-2 A	11/13/07	0.12	<0.02	8.10	0.29	<0.02	0.01	0.45	14.0	13.6	1.1	0.9
S0711436-005	SP-2 B	11/13/07	0.06	<0.02	4.15	0.26	<0.02	<0.01	0	32.7	32.7	0.7	0.3
S0711436-006	SP-3 A	11/13/07	0.77	<0.02	55.0	0.96	<0.02	<0.01	0	6.66	6.66	5.0	5.0
S0711436-007	SP-3 B	11/13/07	0.08	0.10	12.9	0.28	<0.02	0.01	0.44	0.77	0.33	0.6	0.6
S0711436-008	SP-4 A	11/13/07	0.07	2.76	14.5	0.32	<0.02	<0.01	0	15.7	15.7	1.1	0.9
S0711436-009	SP-4 B	11/13/07	0.12	1.59	7.70	0.37	<0.02	<0.01	0	116	116	2.4	1.0
S0711436-010	SP-5 A	11/13/07	0.37	<0.02	57.8	0.64	<0.02	<0.01	0	5.68	5.68	2.8	2.7
S0711436-011	SP-5 B1	11/13/07	0.07	0.12	21.3	0.21	<0.02	<0.01	0	2.13	2.13	0.7	0.6
S0711436-012	SP-6 A	11/13/07	0.17	<0.02	51.6	0.27	<0.02	0.01	0.34	3.63	3.29	2.5	2.4
S0711436-013	SP-6 B	11/13/07	0.25	0.41	16.8	0.14	<0.02	<0.01	0	2.69	2.69	0.7	0.7
S0711436-014	SP-7 A	11/14/07	0.27	12.1	57.5	0.28	<0.02	0.03	1.08	6.60	5.52	4.0	3.9
S0711436-015	SP-7 B1	11/14/07	0.03	2.06	22.8	0.22	<0.02	<0.01	0	2.53	2.53	0.6	0.6
S0711436-016	SP-8 A	11/14/07	0.32	3.96	29.7	0.35	<0.02	0.02	0.72	3.68	2.95	3.7	3.6
S0711436-017	SP-8 B1	11/14/07	0.05	1.12	16.5	0.14	<0.02	<0.01	0	1.60	1.60	0.5	0.5
S0711436-018	SP-9 A	11/14/07	0.66	15.2	21.6	0.67	<0.02	0.03	0.96	7.23	6.27	4.0	3.9
S0711436-019	SP-9 B1	11/14/07	0.09	1.37	8.02	0.27	<0.02	<0.01	0	3.34	3.34	1.1	1.0
S0711436-020	SP-10 A	11/14/07	0.13	2.09	4.74	0.21	<0.02	<0.01	0	106	106	2.1	0.8
S0711436-021	SP-10 B1	11/14/07	0.08	<0.02	3.12	0.28	<0.02	<0.01	0	109	109	2.0	0.7
S0711436-022	SP-10 B2	11/14/07	0.07	0.06	3.65	0.26	<0.02	<0.01	0	310	310	2.9	<0.1
S0711436-023	SP-10 B3	11/14/07	0.06	<0.02	2.95	0.20	<0.02	0.02	0.71	185	184	0.8	<0.1
S0711436-024	SP-11 A	11/14/07	0.15	3.36	5.84	0.49	<0.02	0.01	0.39	141	140	2.9	1.2
S0711436-025	SP-11 B	11/14/07	0.10	4.37	6.26	0.39	<0.02	0.02	0.49	186	185	2.6	0.4
S0711436-026	SP-12 A	11/14/07	0.27	2.68	48.7	0.59	<0.02	0.02	0.54	58.3	57.8	4.0	3.3
S0711436-027	SP-12 B1	11/14/07	0.11	<0.02	8.40	0.40	<0.02	0.02	0.75	209	209	5.2	2.7
S0711436-028	SP-13 A	11/14/07	0.27	0.57	17.6	0.29	<0.02	<0.01	0	83.4	83.4	3.0	2.0
S0711436-029	SP-13 B	11/14/07	0.28	<0.02	14.7	0.34	<0.02	0.02	0.57	233	232	4.3	1.5

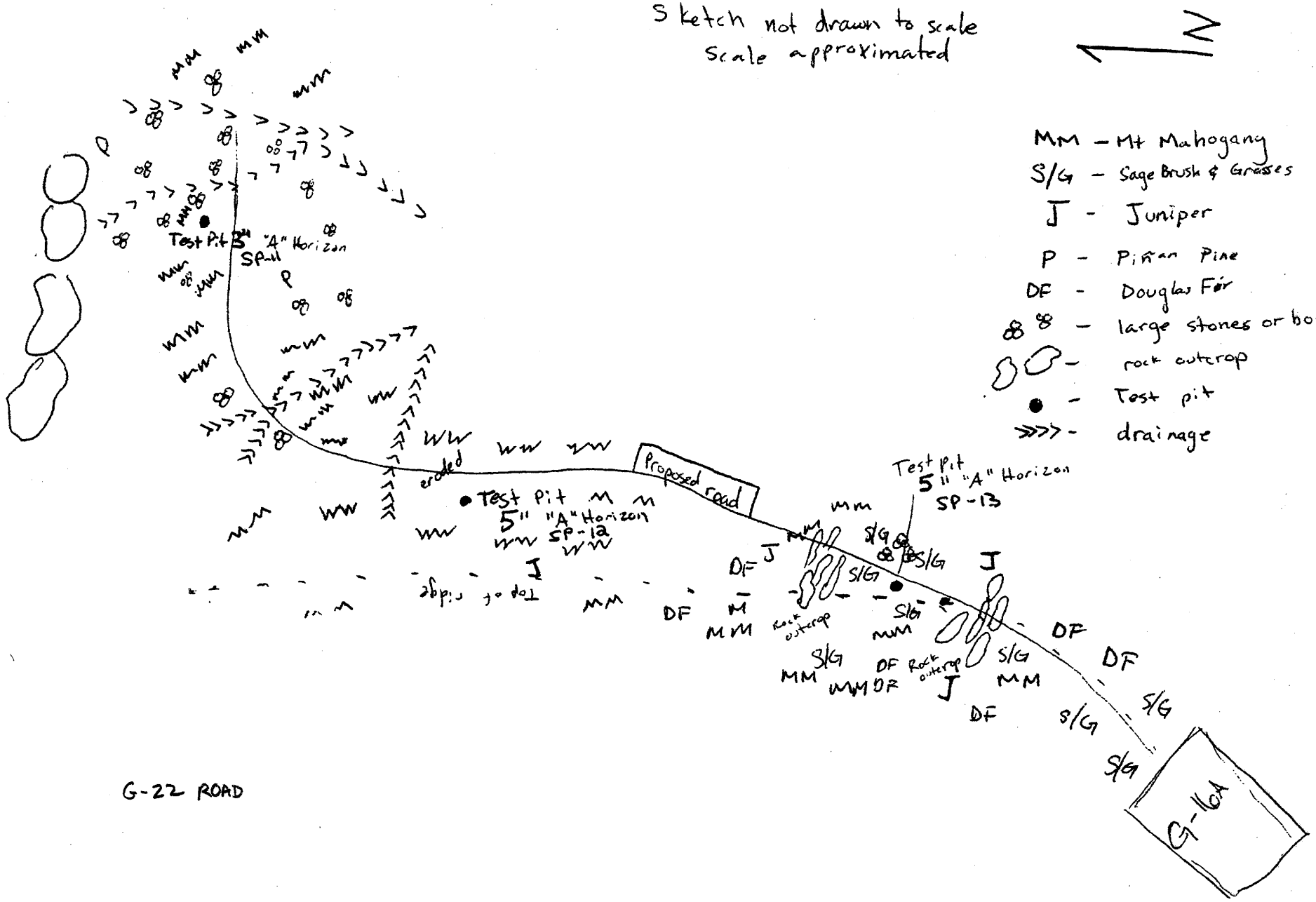
Appendix E

Hand-drawn Maps

Site G-22 road

Scale 1" = 50'

Sketch not drawn to scale
Scale approximated

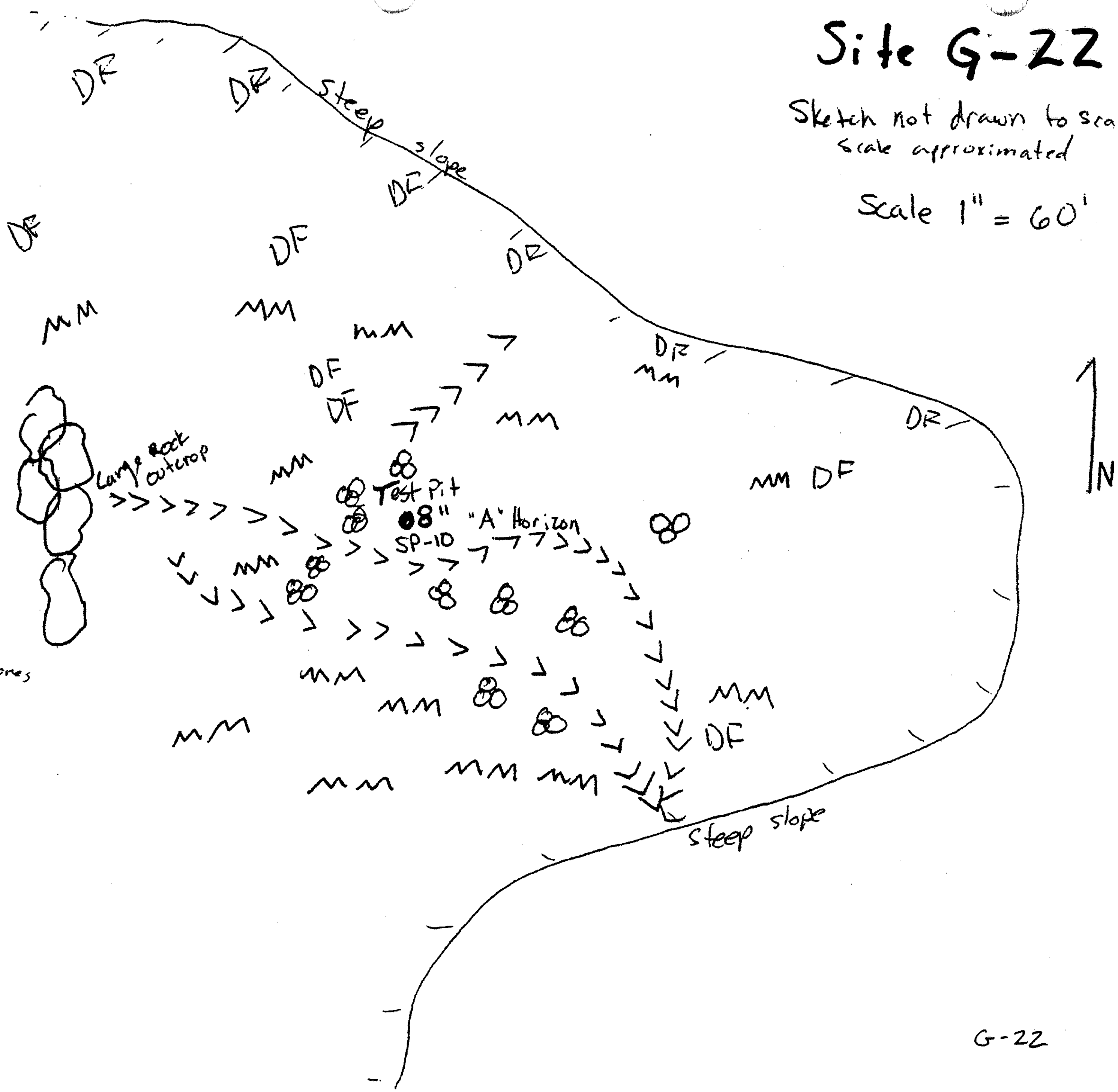


G-22 ROAD

Site G-22

Sketch not drawn to scale
scale approximated

Scale 1" = 60'



MM – Mt. Mahogany
DF – Douglas Fir
● – Test Pit
Boulders or large stones
rock outcrop
>>>>> – drainage

G-22

ATTACHMENT 2-2
TOPSOIL CALCULATIONS

add to the back of existing information

Pad G-22 Summary

Area within Disturbed Area Boundary (ac)	
Pad G-22	1.3
Access Road	2.2
Total	3.5
Disturbed Area Acreage (ac)	
Pad G-22	0.72
Access Road	0.85
Total	1.6
Topsoil Excavation Volume Assuming 10 in. Salvage Depth (cyd)	2,103
Subsoil Volume for Berms (cyd)	140
Topsoil Stockpile Dimensions:	
Stockpile Located on G-17 or G-16 Pad	85' L X 65' W X 12' H

Topsoil Stockpile Capacity Calculations

Stockpile	Length (ft)	Width (ft)	Height (ft)	Volume (yd^3)
Pile on G-17 or G-16	85	65	12	2,103

Notes

In order to minimize the disturbed ara, topsoil will be stockpiled on previously permitted degas well pads, such as G-17 or G-16.

Volume calculated as 0.5* length of base * width * height of pile.

Topsoil will be sloped at approximately 2h:1v. Pile height, slope and capacity calculated and recommended by Priscilla Burton, CPSSc, Environmental Scientist III, Utah Division of Oil, Gas and Mining (Task ID#3068).

CHAPTER 5
ENGINEERING

512.200 Plans and Engineering Designs

Excess Spoil - No excess spoil will be generated from the well sites.

Durable Rock Fills - No durable rock fills will exist at the well sites.

Coal Mine Waste - No coal mine waste will exist at the well sites.

Impoundments - Refer to Section 733.200 of this submittal.

Primary Roads - Short sections of road are required to access well sites G-2, G-5, G-16 and G-22. The G-2 and G-5 road segments are within the footprint of the drill pad and therefore are included within the pads disturbed area boundary. Refer to Attachment 5-4, Plate 4 for the road system accessing the degas well sites. ~~These access roads are classified as primary roads.~~ Well sites G-1 and G-8 (not drilled), G-3 thru G-15, and G-19 are on existing roads, no primary access roads will be constructed. Refer to Section 527.200 for additional information.

Variance from Approximate Original Contour - No variance from approximate original contour is required for the well sites.

513 Compliance with MSHA Regulations and MSHA Approval

513.100 Coal Processing Waste Dams and Embankments

No coal processing waste dams and embankments will exist at the well sites.

513.200 Impoundments and Sedimentation Ponds

Refer to Section 733.200 of this submittal.

520 OPERATION PLAN

521 General

See Figures 5-1, 5-5, 5-9, 5-17, 5-20, 5-23, 5-27 and Attachment 5-1 (G-8 thru G-19, G-22, and G-31) for the contour map showing pre-disturbance and drilling phase contours. These figures also show the disturbed area boundary and the new access road contours. Figures 5-3, 5-7, 5-11, 5-19, 5-22, 5-25, 5-29 and Attachment 5-1 (G-8 thru G-19, G-22, and G-31) show the layout of the well sites during the drilling phase. Figures 5-4, 5-8, 5-12 show the layout of the well sites during the operational phase and the area to be reclaimed at the completion of drilling. Cross sections for each site can be found on Figures 5-2, 5-6, 5-10, 5-18, 5-21, 5-24, 5-28 and Attachment 5-1 (G-8 thru G-19, G-22, and G-31). Attachment 5-1 contains figures showing the road to be constructed to access drill pad G-22, as well as the G-22 drill pad. Cross-sections and profile of the road to degas pad G-22 are located in Attachment 5-1(Figures 2A through 2-E) .

521.100 Cross Sections and Maps

Existing Surface and Subsurface Facilities Features - No buildings are located on or within 1,000 feet of any of the well sites.

Landowner, Right-of-Entry, and Public Interest - The land which the wells will be drilled on is owned by the Milton and Ardith Thayn Trust. Canyon Fuels, LLC has reached an agreement with the Thayn trustees to allow access for the construction and drilling of the wells (see Attachment 4-2).

Mining Sequence and Planned Subsidence - Refer to Section 525. Mining sequence maps showing the location of drilled degas wells are submitted to the BLM and UDOGM as part of their annual reports. A drawing representing the drill holes previously permitted for drilling and those currently proposed for drilling in 2007 are shown on a drawing included in Attachment 5-4. The drawing shows the pad locations not the location where the drill hole will be completed. Drill holes from the G-9 pad were or are being drilled to release gas from the Gil-5 and Gil-6 panels. Drill

holes from the G-10, G-11, G-12, and G-13 pads were drilled to release gas from the Gil-5 panel. Drill holes from the G-15, G-18, G-19, and G-31 pads will be drilled to release gas from the Gil-6 panel.
Drill hole(s) from the G-22 pad will be drilled to release gas from the Gil-8 panel.

Land Surface Configuration - Surface contours of undisturbed well sites are included in Figures 5-1, 5-5, 5-9, 5-17, 5-20, 5-23, 5-27 and Attachment 5-1 (G-8 thru G-19, G-22 (including access road), and G-31).

Surface Facilities - No permanent surface facilities will exist at the well sites.

Degas Well Site Road System - Refer to Attachment 5-4, Plate 4 for the road system accessing the degas well sites.

521.200 Signs and Markers

Mine and Permit Identification Signs - A mine and permit identification sign will be displayed at each well site. This sign will be a design that can be easily seen and read, will be made of durable material, will conform to local regulations, and will be maintained until after the release of all bonds for the well site areas. The sign will contain the following information:

- Mine name,
- Company name,
- Company address and telephone number
- MSHA identification number, and
- Permanent program permit identification number

Perimeter Markers - The perimeter of all areas affected will be clearly marked before beginning mining activities. The markers will be a design that can be easily seen and read, will be made of

527 Transportation Facilities

527.100 Road Classification

Well sites will be developed near existing private roads as shown on Figures 1-1, 5-1, 5-5, 5-9, 5-17, 5-20, 5-23, 5-27 and Attachment 5-1 (G-8 thru G-17 and G-19). The new short segments of access roads will be classified as primary roads and will be maintained by the permittee (see Figure 5-14). The AMV access road will be classified as an ancillary road per a discussion with Wayne Western during a meeting at the UDOGM offices on April 16, 2007. The road is improving a trail used for hunting, cattle and for logging. There are small slash piles along segments of the trail.

The access road to the G-22 pad will be classified as an ancillary road.

527.200 Description of Transportation Facilities

The well sites were chosen close to existing roads in the area to limit surface disturbance. The existing roads were constructed and are maintained by the land owner. The existing roads are approximately 20 feet wide and are shown on Figures 5-1, 5-5, 5-9, 5-17, 5-20, 5-23, 5-27 and Attachment 5-1 (G-8 thru G-17, and G-19). See Figure 5-13 for a typical cross section of the existing roads.

The access road to the G-16 well site follows an existing road which has been reclaimed. The incised road is approximately 500 feet long, 15 to 20 feet wide and will be constructed on compacted subsoil. Topsoil will be stripped from the road alignment and either wind rowed adjacent to the road or stored with the topsoil stripped from the pad area. The access road will have a maximum grade of 10% and an average grade of 5%. The road will be constructed as shown on Figure 5-14 in the approved methane degassification amendment. As needed, water bars will be used to direct flow off the road and either silt fences or strawbales will be used to treat runoff . Refer to Chapter 5, Attachment 5-1 for drawings of well site. The access road to G-16 is also discussed in Chapter 7, Section 732.400.

The AMV access road will be classified as an ancillary road per a discussion with Wayne Western during a meeting at the UDOGM offices on April 16, 2007. The road is improving a trail used for hunting, cattle and for logging. A drawing showing the alignment of the road can be found in Attachment 5-4, as Plate 1. The drawing outlines the disturbed area and shows the road center line, culvert locations, turnouts and topsoil stockpile locations. Topsoil will be removed from the road and stockpiled along the road as shown on Plate 1. The cut and fill volumes for the road have been determined to be close, making it unlikely that subsoil will need to be stored. However, should it be necessary to store subsoil a pile will be created on one of the proposed turnouts. The subsoil pile will be bermed, pocked, gouged and seeded. The topsoil piles will be treated as described in Chapters 2 and 3 of the Methane Degassification Amendment.

A typical road cross section for the AMV road and the G-22 access road is found in Attachment 5-4 as Figure 1. The road will be at a minimum 12 feet wide, with two addition feet of the road width being added as a berm and two feet being used as a ditch, making the road approximately 16 feet wide. Additional descriptive information for the road is located in Attachment 5-4, including cross-sections of the road on Plates 2 and 3 within the attachment.

The steepness of access road cut slopes on the AMV road and access road to G-22 will depend on the stability of the exposed subsurface material. Cuts into competent material such as bedrock will be sloped at angles of approximately 0.5H:1V (63.4 degrees). Cut into unconsolidated material such as soils will be sloped at angles of approximately 1H:1V (45 degrees). The steepness of these slopes is justified by the presence of several near-vertical bedrock outcrops and naturally steep (approximately 1H:1V) colluvial slopes along road cuts in the vicinity of the proposed access road. Furthermore, the nearby cut slopes along access roads have maintained such slopes for several years. Cut slopes will be maintained along the length of the proposed access road. Area determined to be unstable will be regraded to a stable configuration.

When necessary during the normal use of the AMV road and access road to G-22, it will be graded, berms will be repaired, culverts inlets/outlets and ditches will be cleaned. The materials excavated

during road maintenance will be stockpiled to be used for either repair or during reclamation. The AMV road and G-22 access road are not likely to be used during winter due to the access from below the road being impassable, therefore snow removal and storage has not been discussed. Damage to the AMV access road and G-22 access road will be repaired as soon as practical following a catastrophic event. The Division will be notified of a catastrophic event involving the failure of the AMV road, G-22 access road and/or drill pads.

On the AMV road silt fences ~~will be~~ were placed in the ditch upstream of the approach to the culverts to treat road runoff during construction and removed following the completion of road construction. Silt fences ~~will be~~ were placed at the toe of fill slopes prior to road construction to reduce the amount of loose soil material and sediment laden runoff from entering the drainage. Outslopes and ditches associated with the road will be seeded during operations to encourage the establishment of vegetation and erosion control.

The access road to drill pad G-22 is approximately 0.21 miles long, constructed along the contour of the hillside. The road will begin at the edge of permitted drill pad G-16 and proceed west to drill pad G-22. A typical road cross section is found in Attachment 5-4 as Figure 1. The road will be at a minimum 12 feet wide, with two addition feet of the road width being added as a berm and two feet being used as a ditch, making the road approximately 16 feet wide. Outslopes associated with the road will be seeded during operations to encourage the establishment of vegetation and erosion control.

528 Handling and Disposal of Coal, Excess Spoil, and Coal Mine Waste

No disposal of coal, excess spoil, and coal mine waste will occur at the well sites.

529 Management of Mine Openings

The perimeter of the sites, including the topsoil stockpiles will be fenced with gates on the access roads. The well casing will have a valve that is closed and locked. The valve will also prevent

access by animals or other material. Mine openings will be monitored in accordance with Federal and State Regulations.

During the life of the methane wells, the sites will be inspected as needed by mine personnel to verify the continued operation of the pumping equipment and general site conditions. Motorized vehicles to access the methane wells may include trucks, four-wheelers, a snow cat, snowmobiles and etc.

530 OPERATIONAL DESIGN CRITERIA AND PLANS

531 General

This section contains the general plans for the construction of sediment controls and general construction and maintenance of the well sites.

The decision to construct each well will be based on the amount of methane encountered during mining. If small amounts of methane are encountered and the mine's ventilation system can dilute the methane, no well will be drilled. The proposed well site locations are shown on Figure 1-1.

The topography above the Dugout Canyon Mine severely limits the selection of methane drainage drill sites (degas wells). Various other factors also affect the drill site locations. These include proximity to the mining area, existing access verses new access, site slope, meeting reclamation success standards, etc. Sites with exiting access are given preference over sites without, where possible sites are located along existing roads and at other pre-disturbed areas. In addition, drill methods are often modified (using directional drilling methods vs. conventional vertical drilling methods) to allow drilling along existing access and to reduce environmental impacts. Directional drilling methods allow the surface site to be located as described yet allow the bottom of the hole to be completed in the required mining area.

532 Sediment Control

Sediment control measures for the well sites are described in Sections 732 and 742 of this submittal. Runoff control structures at the well sites have been designed to convey runoff in a non-erosive manner. Sediment yields in the well permit area are minimized by:

- Disturbing the smallest practicable area during the construction of the well site and
- Contemporaneously reclaiming areas suitable for such reclamation.

The runoff control measures for the AMV access road are discussed in Attachment 5-4 , Attachment 7-1, Sections 732.400 and 742. The runoff control measure for the G-22 access road are shown on figure in Attachment 5-1, Attachment 7-1, Sections 732.400 and 742.

Silt fences will be placed at the toe of fill slopes of the G-22 access road prior to construction and remain in place to contain loose soils and reduce sediment laden runoff until designated for removal as defined in Section 763.

533 Impoundments

No impoundments will exist at the well sites or on the AMV road, or G-22 access road.

534 Roads

Refer to Section 527 and 532 of this submittal.

535 Spoil

No spoil will be generated at the well sites.

ATTACHMENT 5-2

Methane Degassification

Well No.	Year Constructed		Year Plugged		Contemporaneous Reclamation		Final Reclamation	
	Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual
G-2		2004			2007			
G-3		2004		2005		2005		2006
G-4		2004		2005				2005
G-5		2004			2007			
G-6		2004		2005				2007
G-7		2005		(A) 2008				
G-9		2005			2008			
G-10	2006				2007			
G-11	2006			2008				
G-12	2006				2007			
G-13	2006			2008				
G-14	2006				2008			
G-15	2007				2008			
G-16	2008							
G-17	2009							
G-18	2007				2009			
G-19	2007				2008			
G-22	2009							
G-31	2007				2009			

Dates are approximate, all events are subject to availability of contractors, weather, mining needs, etc.

Although permitted, wells G-1 and G-8 were never drilled/constructed.

ATTACHMENT 5-4

Degas Wells Access Road

CHAPTER 7

HYDROLOGY

Once drilling is completed, the casing is grouted in the well hole, sealing aquifers to prevent groundwater migration, including groundwater migrating down the outside of the casing into the mine. Should water inflow greater than 15 gallon per minute be encountered during the drilling of the degas wells the depth and volume will be recorded and included in Attachment 7-1. No measurable inflows of water have been encountered during the drilling of degas wells G-1 thru G-9. Water was encountered while drilling degas wells G-18A and G-31A, but the inflows were not measurable.

The development and construction of degas wells does not have the potential to decrease creek flow or spring discharges, the wells are not designed to capture water, dewater aquifers or cause subsidence. Methane gas, not liquid (water) is pumped from the wells following construction.

Surface Water - Degas wells are not used to access water to be discharged to the surface. As mentioned above, no measureable water has been encountered during the drilling, construction and operation of degas wells G-1 thru G-9. Also, the well cannot function as a degas well if significant water is encountered, and will need to be abandoned.

Potential Hydrocarbon Contamination - Hydrocarbon products will not be stored at the well sites, however fuels, greases, and other oils may leak from equipment during drilling operations. Absorbent materials will be used for the collection of leaked fuels, greases, and other oils. The saturated absorbent materials will be disposed of at an appropriate landfill facility.

G-18, G-31 and AMV Access Road

728.300 The PHC Determination:

728.310 - The construction and operation of the G-18, G-31 well pads and associated access road is not anticipated to cause adverse impacts to the hydrologic balance. Several springs are located in the drainage in which the road begins. One small seep, SC-96, has been recorded a short distance down hill of a portion of the road near the center of Section 20, T13S R13E. However, this seep has not been observed flowing the past several year, which could be due to the

dry climatic conditions the area has experienced. It should be understood that SC-96 is not a seep monitored on a quarter basis. It is unlikely the construction and operation of the road will impact the aquifer that has discharged at the seep since road construction will not require significant excavation or over the aquifer outcrop. Sediment control structures will be used to reduce the amount of suspended material that will leave that portion of the disturbed area of the road during runoff events that is directed to the small drainage where the seep is located. The remaining seeps and springs are located upstream of the road and near the canyon head. These groundwater discharge locations should not be impacted by road construction and operation since the aquifers feeding these discharges will either not be encountered during construction or minimal disturbance at the outcrops of the up-dip end of the aquifer will occur.

Sediment control structures will be used to reduce the likelihood of erosion and increased sediment loads greater than background to the ephemeral and intermittent drainage areas. Sediment controls have been designed to adequately address treatment of runoff from the steep hillsides and grades associated with the access road. The locations, designs, and descriptions of the sediment control structures to be implemented during road and pad construction, operation, and reclamation are contained in Attachments 5-4 and 7-1.

Examples of construction and operational sediment and erosion control on the road include building appropriately sized water bars or the canting of the road surface toward the uphill side of the road to divert runoff into the roadside ditch. When necessary the water bar outlets will be rip rapped with native rock. Native rock will be collected during the construction of the road to be used as rip rap. Culverts will be located at appropriate sites (Attachment 5-4, Plate 1) to direct flow from the ditch to drainages that would normally contain the area runoff. Where required appropriately sized rip-rap will be placed at the outlet of the culverts used to divert water into the existing ephemeral drainages.

According to calculations, culvert inlet velocities should be less then 5 fps, therefore no inlet protection is required. Silt fences ~~will also be~~ were placed on the upstream end of the approach to the culverts to treat road runoff during construction and were removed following completion of the

construction. Silt fences ~~will be~~ were placed at the toe of fill slopes during construction to reduce the amount of loose soil material and sediment laden runoff from entering the drainage. Outslopes and ditches associated with the road will be seeded during operations to encourage the establishment of vegetation and erosion control.

Erosion, runoff and sediment control at pads G-18 and G-31during construction, operation, and reclamation may include, but not necessarily be limited to, construction of berms around the disturbed areas and the use of silt fence to treat runoff.

Reclamation of the road and well pads is described in Sections 340 and 760. As part of the reclamation activities the reclaimed and resoiled surfaces will be deep gouged to reduce the length of surface flow paths and trap runoff. The reclamation plan described in these sections have been designed to minimize erosion and runoff by encouraging timely revegetation of the disturbed areas. ~~Where necessary,~~ Silt fencing will be used as defined in the approved reclamation plan during reclamation activities to contain loose soils and reduce sediment laden runoff.

728.320 - Soil samples have been obtained from selected sites in the road and pad areas. Results of the soil analyses indicate the samples did not contain acid-forming or toxic-forming materials. Thus, the soils moved or exposed as a result of the construction of the road and pad will not result in the contamination of the surface or ground-water supplies. Refer to Section 231 and Attachment 2-1.

728.330 - The sediment control structures to be constructed as part of the access road and G-18 and G -31 well pads project should minimize the sediment yield from disturbed areas during runoff events. As described in Section 527 and above in Section 728.310, silt fencing will be used at the downhill toe of the slope of the road fill during road construction to capture loose soils and rock. This will prevent loose material from entering the channels.

As described in the preceding sections, acid forming materials will not be exposed or created as part of the construction, operation, or reclamation of the road and pad areas. Total suspended

solids will be controlled through the use of sediment control structures. Dissolved solids within the runoff from the disturbed areas is not likely to noticeably increase above background levels since the disturbance is generally occurring within weathered soils and bedrock surfaces. Much of the soluble material will have naturally leached from the shallow soils prior to the proposed disturbance. The soil samples obtained and analyzed are located in Attachment 2-1 and referenced in Section 728.320 above do not contain significant volumes of highly soluble minerals. Therefore, it is unlikely exposing these soils to increased moisture will result in increased total dissolved solids in the surface water relative to known background levels. No significant volumes of highly soluble materials are proposed to be imported as part of the construction, operation, and reclamation of the road and pad.

No impoundments or restriction of stream flows are anticipated as part of the road and pad project, making it unlikely that unnatural flooding will occur as a result of this project. No additional or new perennial or intermittent stream channel alterations are anticipated as part of this project. Culverts are to be placed in ephemeral channels at road crossings. The culverts are adequately sized such that flooding due to the placement of the culverts should not occur. Only minimal alteration to the ephemeral channels will occur during the placement of the culverts.

No groundwater is anticipated to be encountered during construction of the road or pads, therefore no change in groundwater availability is anticipated. Minimal amounts of surface water will be used for dust suppression during construction and operation of the road and pads.

728.340 - The sediment controls installed during construction, operation, and reclamation of the road and pad will not proximately result in contamination, diminution or interruption of an underground or surface source of water within the proposed permit or adjacent areas which is used for domestic, agricultural, industrial or other legitimate purpose.

728.350 - Five ephemeral drainages will be diverted by culverts placed at various locations along the length of the AMV access road. Because of the installation of the sediment controls and since no ground water and only surface water as described previously will be diverted as a result

of this project, the road and pad construction will result in imperceptible contamination, diminution or interruption of State-appropriated water in existence within the proposed permit or adjacent areas at the time the application is submitted.

G-22 Access Road and Pad

728.300 The PHC Determination:

The construction and operation of the G-22 well pad and associated access road is not anticipated to cause adverse impacts to the hydrologic balance. Sediment control structures will be used to reduce the amount of suspended material that will leave that portion of the disturbed area of the road during runoff events. Silt fences will be placed at the toe of fill slopes of the G-22 access road prior to construction and remain in place until designated for removal as defined in Section 763. There are no known springs in the path of the road or in the immediate area of the road and drill pad.

Sediment controls have been designed to adequately address treatment of runoff from the steep hillsides and grades associated with the access road. The locations, designs, and descriptions of the sediment control structures to be implemented during road and pad construction, operation, and reclamation are contained in Attachments 5-4 and 7-1.

Examples of construction and operational sediment and erosion control on the road include building appropriately sized water bars or the canting of the road surface toward the uphill side of the road to divert runoff into the roadside ditch. When necessary the water bar outlets will be rip rapped with native rock. Native rock will be collected during the construction of the road to be used as rip rap. Culverts will be located at appropriate sites (Figure 1, Contour Map for G-22, Attachment 5-1) to direct flow from the ditch to drainage(s) that would normally contain the area runoff. Figure 1 shows the location of a culvert to be installed in the ephemeral drainage, if determined necessary to assist in directing flow, one or two additional culverts may be installed in the drainage at the same location.

According to calculations, culvert inlet velocities should be less then 5 fps, therefore no inlet protection is required. Culvert outlet will be riprapped and filter fabric will be placed beneath the riprap as shown on Figure 2 in Attachment 7-1. The filter cloth will be installed per manufacturers recommended methods for the intended purpose(s). A copy of the Tencate Mirafi installation guidelines are provided in Attachment 7-1. ~~Siltfences will be placed at the toe of fill slopes during construction to reduce the amount of loose soil material and sediment laden runoff from entering the drainage and removed in the Spring of 2009. Outslopes and ditches associated with the road will be seeded during operations to encourage the establishment of vegetation and erosion control.~~

Erosion, runoff and sediment control during construction, operation, and reclamation may include, but not necessarily be limited to, construction of berms around the disturbed areas and the use of silt fence to treat runoff from the drill pads. The location of the silt fence to treat runoff from the drill pad are shown on Figure 1, G-22 in Attachment 5-1.

Reclamation of the road and well pads is described in Sections 340, 350 and 760. As part of the reclamation activities the reclaimed and resoiled surfaces will be deep gouged to reduce the length of surface flow paths and trap runoff. The reclamation plan described in these sections have been designed to minimize erosion and runoff by encouraging timely revegetation of the disturbed areas. ~~Where necessary, Silt fencing will be used during reclamation activities to contain loose soils and reduce sediment laden runoff.~~ Silt fences will be placed at the toe of fill slopes of the G-22 access road prior to construction and remain in place to contain loose soils and reduce sediment laden runoff until designated for removal as defined in Section 763.

Soil samples have been obtained from selected sites in the road and pad areas. Results of the soil analyses indicate the samples did not contain acid-forming or toxic-forming materials. Thus, the soils moved or exposed as a result of the construction of the road and pad will not result in the contamination of the surface or ground-water supplies. Refer to Section 231 and Attachment 2-1.

As described in the preceding sections, acid forming materials will not be exposed or created as part of the construction, operation, or reclamation of the road and pad areas. Total suspended solids will be controlled through the use of sediment control structures. Dissolved solids within the runoff from the disturbed areas is not likely to noticeably increase above background levels since the disturbance is generally occurring within weathered soils and bedrock surfaces. It is unlikely exposing these soils to increased moisture will result in increased total dissolved solids in the surface water relative to known background levels. No significant volumes of highly soluble materials are proposed to be imported as part of the construction, operation, and reclamation of the road and pad.

Since the drainages associated with the G-22 pad and access road are ephemeral no ~~additional or new~~ perennial or intermittent stream channel alterations are anticipated as part of this project. Culvert(s) are to be placed in an ephemeral channel at road crossings. The culverts are adequately sized such that flooding due to the placement of the culverts should not occur. If determined necessary to assist in directing flow, one or two additional culverts may be installed in the drainage in approximately the same location as shown on Figure 1 Contour Map for G-22 in Attachment 5-1. Only minimal alteration to the ephemeral channels will occur during the placement of the culverts.

No groundwater is anticipated to be encountered during construction of the road or pads, therefore no change in groundwater availability is anticipated. Minimal amounts of surface water will be used for dust suppression during construction and operation of the road and pads.

Th~~ese~~ groundwater/surface water discharge locations should not be impacted by road construction and operation since the aquifers feeding these discharges will either not be encountered during construction or minimal disturbance at the outcrops of the up-dip end of the aquifer will occur.

729 Cumulative Hydrologic Impact Assessment (CHIA)

The Cumulative Hydrologic Impact Assessment currently in place for the Dugout Canyon Mine includes the well sites and adjacent areas.

730 OPERATION PLAN

731 General Requirements

731.100 Hydrologic - Balance Protection

Groundwater Protection - The effect on groundwater at the well sites is expected to be minimal. Groundwater encountered during drilling will be sealed off, refer to Section 728.300.

Surface Water Protection - To protect the hydrologic balance, construction, maintenance, and reclamation operations will be conducted to handle earth materials and runoff in a manner that prevents, to the extent possible, additional contributions of suspended solids to stream flow outside the permit area, and otherwise prevent water pollution.

During initial drilling, the sites will be graded to ensure that storm runoff will flow towards the berms surrounding the drilling pad area. The berms will direct the runoff to the lowest point(s) within the pad area where a silt fence and/or straw bale dike(s) will treat the runoff (see Figures 5-1, 5-5, 5-9, 5-17, 5-20, 5-23, 5-27 and Attachment 5-1). The berm placed at the top of the drilling pad cut slopes will divert runoff around the drilling pad. Thus reducing the runoff affected by the drilling pad.

The pad will be re-graded to cause the storm runoff to sheet flow towards a silt fence and/or straw bale dike. A berm will be placed at the top of the fill slope to direct any runoff from the operational pad to the silt fence and/or straw bale dike(see Figures 5-4, 5-8, 5-12, 5-19, 5-22, 5-25, 5-29 and Attachment 5-1). The silt fences and/or straw bale dikes will be periodically inspected, and accumulated sediment will be removed as needed to maintain functionality. The sediment from the silt fence and/or straw bale dikes will be piled on the pad and will be used for fill during final

reclamation of the well site. During the drilling phase a berm and silt fence will be installed at the toe of the fill slope as shown on Figures 5-1, 5-5, 5-9, 5-17, 5-20, 5-23, 5-27 and Attachment 5-1 to treat any runoff from the drilling pad.

731.200 Water Monitoring

No water monitoring will be conducted at the degas well sites. Refer to approved M&RP for a description of water monitoring.

731.300 Acid or Toxic Forming Materials

No acid or toxic forming materials are anticipated at the well sites (see Section 728.300).

731.400 Transfer of Wells

Refer to Section 731.400 of the approved M&RP.

731.500 Discharge

No discharges to underground workings.

731.600 Stream Buffer Zones

Stream Channel Diversions - No stream channel diversions are planned at the well sites, unless specified in the runoff controls specific to each well site. Streams in five ephemeral drainages will be diverted with the installation of culverts at various locations along the AMV road.

Buffer Zone Designation - When drilling sites are adjacent to a perennial or an intermittent stream, a stream buffer zone will be established. Well sites G-11, G-12, G-15 and G-19 require

buffer zone designation. The G-22 drill site and the associated access road are not adjacent to a perennial or an intermittent stream, therefore a buffer zone designation is not required, for additional information refer to Section 324. Refer to Chapter 5, Attachment 5-1 for drawings of well sites G-8 through G-17, G-19, G-22, G-22 access road and G-31. A buffer zone designation will be required on approximately the first 1100 feet of the AMV road, signs will be placed along the road at intervals so that the previous sign is visible at the location of the current sign.

731.700 Cross Section and Maps

Not applicable.

731.800 Water Rights and Replacement

Refer to Sections 728.300 and 731.800 of the approved M&RP.

732 Sediment Control Measures

The sediment control measures within the well sites have been designed to prevent additional contributions of sediment to stream flow or to runoff outside the well sites. In addition, the well sites have been designed to minimize erosion to the extent possible.

The structures to be used for runoff control at the well sites are berms, silt fences and/or straw bale dikes.

Structure Inspection

The structures installed by the permittee will be periodically inspected at degas drill sites and associated access roads which have been construction by the permittee. The inspections will include but not be limited to inspections following major precipitation events. Division staff qualified in the construction and maintenance of structures commits to bi-annual inspections, one inspection in the spring or early summer and one in the fall. Following inspections, when needed the

structures will be repaired and accumulated sediment removed when the accumulated sediment threatens the proper function of the structures.

732.100 Siltation Structures

Berms, silt fences and straw bales dikes will be used to treat runoff.

732.200 Sedimentation Pond

The drilling sites will not have sedimentation ponds.

732.300 Diversions

Refer to Section 731.100 of this submittal.

732.400 Road Drainage

No diversion ditches will be constructed along the primary roads leading to the well sites. See Figures 5-13 and 5-14 for typical road cross sections. Where needed roads accessing the drill sites will have a water bar constructed at the base of the road to divert water off the road prior to the runoff reaching the drilling pad.

The incised road to well site G-16 will be constructed as shown on Figure 5-14 in the approved permit, water bars will be used to direct flow off the road and either silt fences or strawbales will be used to treat runoff . Refer to Chapter 5, Attachment 5-1 for drawings of well site G-16 showing the location of a single water bar, additional water bar(s) will be constructed as required to direct water from the road. Refer to Section 527.200 for road construction information.

740 DESIGN CRITERIA AND PLANS

741 General Requirements

This submittal includes general well site plans that incorporate design criteria for the control of drainage.

742 Sediment Control Measures

742.100 General Requirements

Design - Sediment control measures have been formulated to prevent additional contributions of sediment to stream flow or to runoff outside the well site area; and minimize erosion to the extent possible.

Measures and Methods - Sediment control methods will include silt fences, berms, and straw bales to reduce runoff and trap sediment.

742.200 Siltation Structures

General Requirements - Additional contributions of suspended solids and sediment or runoff outside the well site area, including access roads will be prevented to the extent possible using silt fences, berms, and straw bale dikes. Construction activities will not occur during major precipitation events. As required, siltation structures will be installed prior to beginning site construction. For additional information pertaining to siltation structures, refer to Sections 728.300 and 732.

Design - All hydrology calculations were made using the 10-year, 24-hour precipitation event. Hydrology calculations are in Attachment 7-1. Locations of the berms and silt fences are shown on Figures 5-1, 5-4, 5-5, 5-8, 5-9, 5-12, 5-17, 5-20, 5-23, 5-27 and Attachment 5-1.

742.300 Diversions

No diversion ditches will be constructed as part of the drilling or operational phases, with the exception of the AMV road and G-22 access road.

742.400 Road Drainage

Refer to Section 732.400 of this submittal. The road design for G-16 is shown on drawings located in Chapter 5, Attachment 5-1 and Figure 5-16. The road design for the AMV access road is shown in Attachment 5-4. The G-22 access road design is located in Attachment 5-1 and additional information pertaining to the road drainage is located in Sections 728.300 ,732, 742, and 760.

743 Impoundments

No impoundments will exist at the well sites.

744 Discharge Structures

No discharge structures have been planned or designed.

745 Disposal of Excess Spoil

There will be no excess spoil generated at the well sites.

746 Coal Mine Waste

746.100 General Requirements

There will be no coal mine waste used at the well sites.

746.200 Refuse Piles

There will be no refuse piles at the well sites.

746.300 Impounding Structures

Refer to Section 733.200 of this submittal.

746.400 Return of Coal Processing Waste to Abandoned Underground Workings

No coal processing waste will be generated at the well sites.

747 Disposal of Non-Coal Mine Waste

All non-coal mine waste will be dispose of at an approved landfill.

748 Casing and Sealing Wells

Refer to Section 542.700 of this submittal.

750 PERFORMANCE STANDARDS

751 Water Quality Standards and Effluent Limitations

Water encountered during drilling and runoff water will be treated using silt fence and/or straw bale dikes prior to leaving the site. Should it become necessary the water encountered during drilling will be pumped into a tank and hauled from the site for disposal at a licensed facility.

752 Sediment Control Measures

All sediment control measures will be located, maintained, constructed and reclaimed according to plans and designs presented in Sections 728.300 ,732, 742, and 760 of this submittal.

752.100 Siltation Structures and Diversions

Siltation structures will be located, maintained, constructed and reclaimed according to plans and designs presented in Sections 728.300,732, 742, and 763 of the submittal.

752.200 Road Drainage

Refer to Section 732.400 of this submittal.

753 Impoundments and Discharge Structures

Refer to Section 733.200 of this submittal.

754 Disposal of Excess Spoil, Coal Mine Waste and Non-Coal Mine Waste

There will be no excess spoil or coal mine waste generated at the well sites. Refer to Section 747 of this submittal regarding non-coal waste disposal.

755 Casing and Sealing

Refer to Section 542.700 of this submittal.

760 RECLAMATION

761 General Requirements

A detailed reclamation plan for the well sites is presented in Section 540. No structures will exist at the well sites.

762 Roads

Refer to Section 542.600.

762.100 Restoring the Natural Drainage Patterns

The natural drainage patterns will be restored after degassification is completed.

762.200 Reshaping Cut and Fill Slopes

Cut and fill slopes will be reshaped at the well sites.

763 Siltation Structures

763.100 Maintenance of Siltation Structures

~~All siltation structures will be maintained until removed in accordance with the approved reclamation plan.~~ Siltation structures will be maintained until removal is authorized by the Division and the disturbed area has been stabilized and revegetated. The siltation structures will be removed no sooner than two years after the last augmented seeding.

763.200 Removal of Siltation Structures

When a siltation structure is removed, the land on which the siltation structure was located will be regraded and revegetated in accordance with the reclamation plan presented in Section 540, Section 356, Section 357 and Section 358.

764 Structure Removal

A timetable for the reclamation of the sites is presented in Figures 5-15 (G-2 and G-5) and 5-26 (G-3, G-4, G-6 thru G-19, G-22, G-22 access road, G-31 and AMV access road).

765 Permanent Casing and Sealing of Wells

Refer to Section 542.700 of this submittal.

ATTACHMENT 7-1
HYDROLOGY CALCULATIONS

add to the back of existing information

TENCATE
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INSTALLATION GUIDELINES FOR GEOTEXTILES USED IN FILTRATION AND DRAINAGE APPLICATIONS

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INSTALLATION GUIDELINES FOR GEOTEXTILES USED IN FILTRATION AND DRAINAGE APPLICATIONS

GENERAL

This document is prepared to help ensure that a subsurface drainage geotextile, once installed, will perform its intended design function. To do so, the geotextile must be identified, handled, stored, and installed in such a way that its physical property values are not affected and that the design conditions are ultimately met as intended. This document contains information consistent with generally accepted methods of identifying, handling, storing and installing geotextile materials. Failure to follow these guidelines may result in the unnecessary failure of the geotextile in a properly designed application.

MATERIAL IDENTIFICATION, STORAGE AND HANDLING

The geotextile shall be rolled on cores having strength sufficient to avoid collapse or other damage from normal use. Each roll shall be wrapped with a plastic covering to protect the geotextile from damage during shipping and handling, and shall be identified with a durable gummed label or the equivalent, clearly readable on the outside of the wrapping for the roll. The label shall show the manufacturer's name, the style number, and the roll number. Roll identification corresponding to the proposed location of the roll as shown on the construction drawings and as approved by the Engineer, Owner and Contractor can be provided.

While unloading or transferring the geotextile from one location to another, prevent damage to the wrapping, core, label, or to the geotextile itself. If the geotextile is to be stored for an extended period of time, the geotextile shall be located and placed in a manner that ensures the integrity of the wrapping, core, and label as well as the physical properties of geotextile. This can be accomplished by elevating the geotextile off the ground on dunnage and ensuring that it is adequately covered and protected from ultraviolet radiation including sunlight, chemicals that are strong acids or strong bases, fire or flames including welding sparks, temperatures in excess of 60°C (140°F), and human or animal destruction.

Before unrolling the geotextile, verify the roll identification, length, and installation location with the contract drawings. While unrolling the geotextile, inspect it for damage or defects. Repair any damage that occurs during storage, handling or installation as directed by the Engineer. Normally light traffic will not damage the exposed geotextile. However, as a safety precaution, it is recommended that traffic not run on exposed geotextile.

FRENCH AND TRENCH DRAINS

Site Preparation

Excavate the drainage trench to the design dimensions, placing excavated material well away from the sides of the trench. If unstable soil conditions exist, it may be necessary to excavate a trench with sloping sides to ensure wall integrity during the rest of the project. Trim any large roots to be flush with the trench sides to prevent puncturing or tearing the geotextile. Refill any voids with fill dirt so that the excavation sides are smooth.

Geotextile Placement

Cut geotextile to proper width prior to placement. Width should be enough to conform to the trench perimeter with at least a 15 cm (6 in) top overlap. Place the geotextile roll over the trench and unroll enough geotextile that the geotextile can be placed down into the trench. Anchor the edges of the geotextile with heavy objects to prevent the geotextile from falling into the trench. Where overlaps are necessary between rolls, allow for 1 m (3 ft) overlap from the upstream to the downstream roll.

Aggregate Placement and Compaction

If drainage pipes are to be used, place a 8 cm (3 in) to 15 cm (6 in) layer of drainage aggregate on top of the geotextile, then install the drainage pipe.

Fill the trench with the specified aggregate and compact using plate compactors. Ensure that no foreign material is included in the aggregate. Compact aggregate in a way that ensures geotextile conformity to the excavation sides. Allow for a maximum loose lift thickness of 30 cm (12 in). Fold leftover geotextile over aggregate to form a longitudinal lap. Backfill the trench to the recommend specifications.

BLANKET DRAINS

Site Preparation

Grade the protected soil surface to be smooth. Remove any roots, vegetation or sharp objects that might puncture or tear the geotextile. Fill in any surface voids that might exist.

Initial Geotextile Layer Placement

Place the geotextile to be as smooth and wrinkle free as possible. Make any laps in either direction to be at least 1 m (3 ft) wide. Allow enough geotextile to conform to the surface, over top of any edge drains and to cover the aggregate raft with a 1 m (3 ft) overlap. In order to keep geotextile in place during installation of the aggregate, pin the geotextile to the ground.

Drainage Aggregate Placement

Place the aggregate using lifts such that no equipment is operated directly on the geotextile. Smooth the aggregate to the thickness designed by the engineer. If edge drains are to be used, follow the above procedures for filling a French or Trench drain.

Cover Geotextile Layer Placement

Lap the remaining geotextile over the aggregate raft following the same overlap dimension requirements stated above. Smooth any wrinkles that may form during geotextile placement. Secure the geotextile with pins, sand bags or other heavy objects until the cover material can be applied.

Cover Material Placement

Place cover material in lifts such that no equipment is operated directly on the geotextile. Begin placement of the cover material at the downstream end of the drain (if possible). Place at minimum, enough cover material that the geotextile will be protected from ultraviolet degradation.

✳ BANK STABILIZATION / ROCK (ARMOR) UNDERLAYMENT

Site Preparation

Clear the site of all large stones, roots, or other debris that might damage the geotextile. Excavate and shape the site to the lines and grades as directed by the Engineer. Fill depressions or holes to ensure intimate contact between the geotextile and the prepared surface.

Place the geotextile in close contact with the soil, eliminating folds or excessive wrinkles both longitudinally and transversely. The geotextile need not be placed in tension before covering with riprap or other materials. Use care in placing the geotextile to avoid possible damage.

The geotextile can be joined by overlapping or sewing. The minimum overlap distance in the transverse or longitudinal direction is 0.6 m (2 ft), except in underwater installations where the minimum overlap is 1 m (3 ft). Sewn seams are allowed if the overlap in the transverse or longitudinal direction is at least 15 cm (6 in).

Anchor the geotextile firmly at the top of the slope using an anchor trench. For maximum effectiveness, the trench should be at least 1 m (3 ft) from the crest of the slope and at least 0.6 m (2 ft) deep. Thoroughly compact soil in the trench to ensure good anchorage.

When placing geotextile along a stream or other places where water movements are expected, anchor the toe of the geotextile in a similar fashion as at the top to prevent scour beneath it.

Rock (Armor) Placement

Stone or armor block shall be placed directly on the geotextile material as directed by the Project Engineer. Riprap and heavy rock cover shall not be dropped onto the geotextile from a height of more than 0.3 m (1 ft). Slope protection and smaller sizes of rock cover shall not be dropped onto the geotextile from a height exceeding 1 m (3 ft). Any geotextile damaged during placement shall be replaced as directed by the Project Engineer.